REVIEWED: APPLE WATCH SERIES 7

iPad&iPhone user

ISSUE 176

FROM IDG

ULTIMATE iPHONE BUYING GUIDE

VISIT…

NEWS

4 These are the top Apple apps and games of 2021

6 Apple's custom-built 5G modem due to land in 2023

7 Apple won't have to make any immediate App Store changes in Epic case

10 Google's fix for ugly and annoying Android-iPhone chats is finally here

12 Razer has made a giant MagSafe fan with RGB lights because it can

NEWS ANALYSIS

14 Once more for the people in the back: iPhone sales are just fine

iPHONE

17 5 things I learned by switching from the iPhone 12 mini to the 13 Pro Max

21 The iPhone was this close to being an exclusive Xbox handheld gaming system

23 Best iPhone 2022: Which model is right for you?

APPLE WATCH

103 Review: Apple Watch Series 7

107 Apple Watch Series 7 versus Series 6

AIRPODS

114 Apple made a pair of clear AirPods and we want them

These are the top Apple apps and games of 2021

Apple honours the best iPhone, iPad and Mac apps of the year. **Michael Simon** reports

Apple has honoured the top apps of 2021. The winners included developers whose 'apps and games were selected by Apple's global App Store editorial team for delivering exceptional quality, innovative technology, creative design and positive cultural impact'. Here are the winners as selected by the App Store editorial team:

iPhone App of the Year: Toca Life World, from Toca Boca

iPad App of the Year: LumaFusion, from LumaTouch

Mac App of the Year: Craft, from Luki Labs Limited

Apple Watch App of the Year: Carrot Weather, from Grailr

iPhone Game of the Year: League of Legends: Wild Rift, from Riot Games

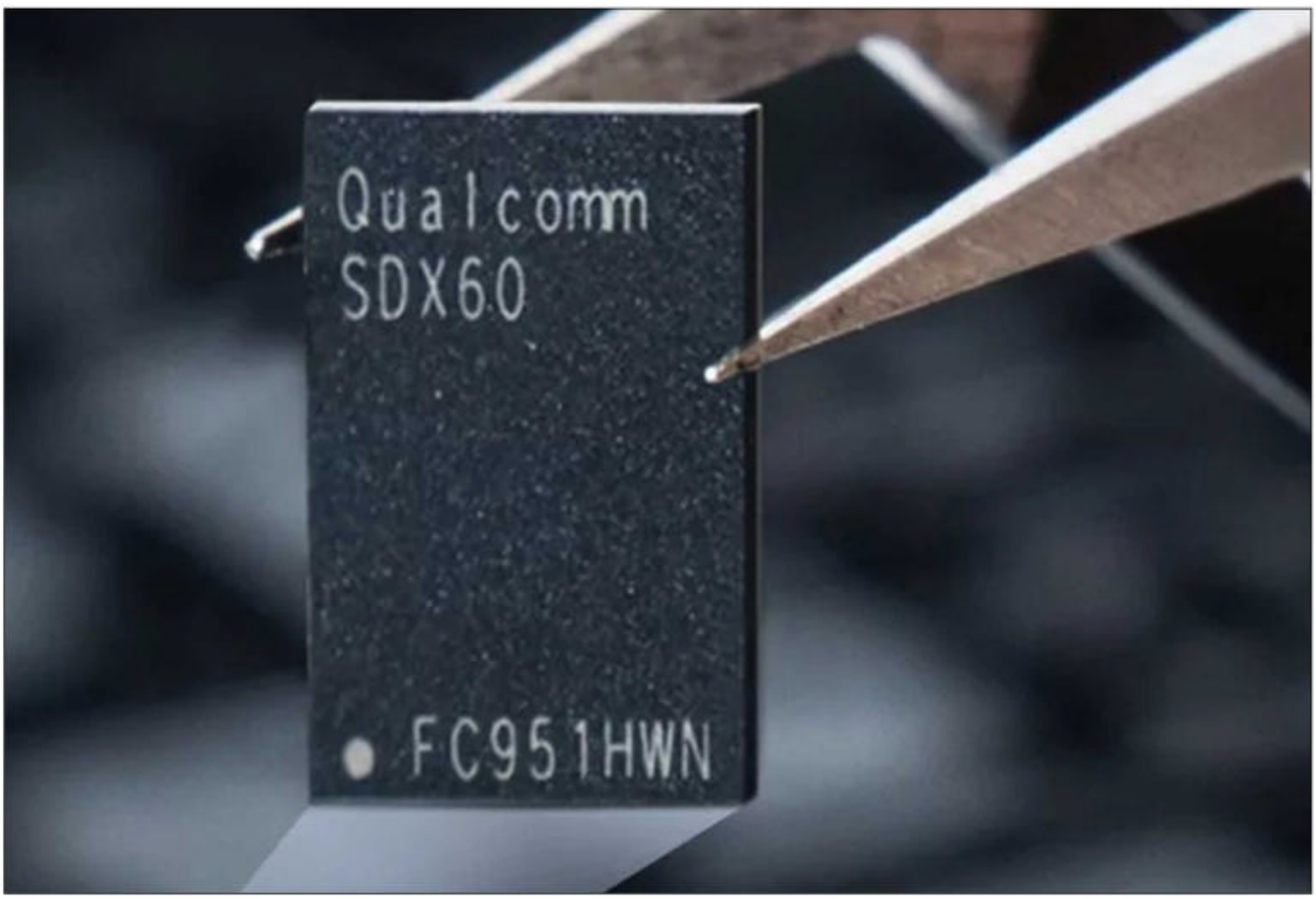
iPad Game of the Year: Marvel Future Revolution, from Netmarble Corporation

Mac Game of the Year: Myst, from Cyan

Apple TV Game of the Year: Space Marshals 3, from Pixelbite

Apple Arcade Game of the Year: Fantasian, from Mistwalker

Additionally, the 'trend' of the year was Connection, celebrating apps that 'brought people together in meaningful ways – while meeting social, personal, and professional needs for users around the world'. Among the winners are Among Us!, Bumble, Canva, EatOkra and Peanut.



Apple's custom-built 5G modem due to land in 2023

But it may not be integrated into A17 chip. **Michael Simon** reports

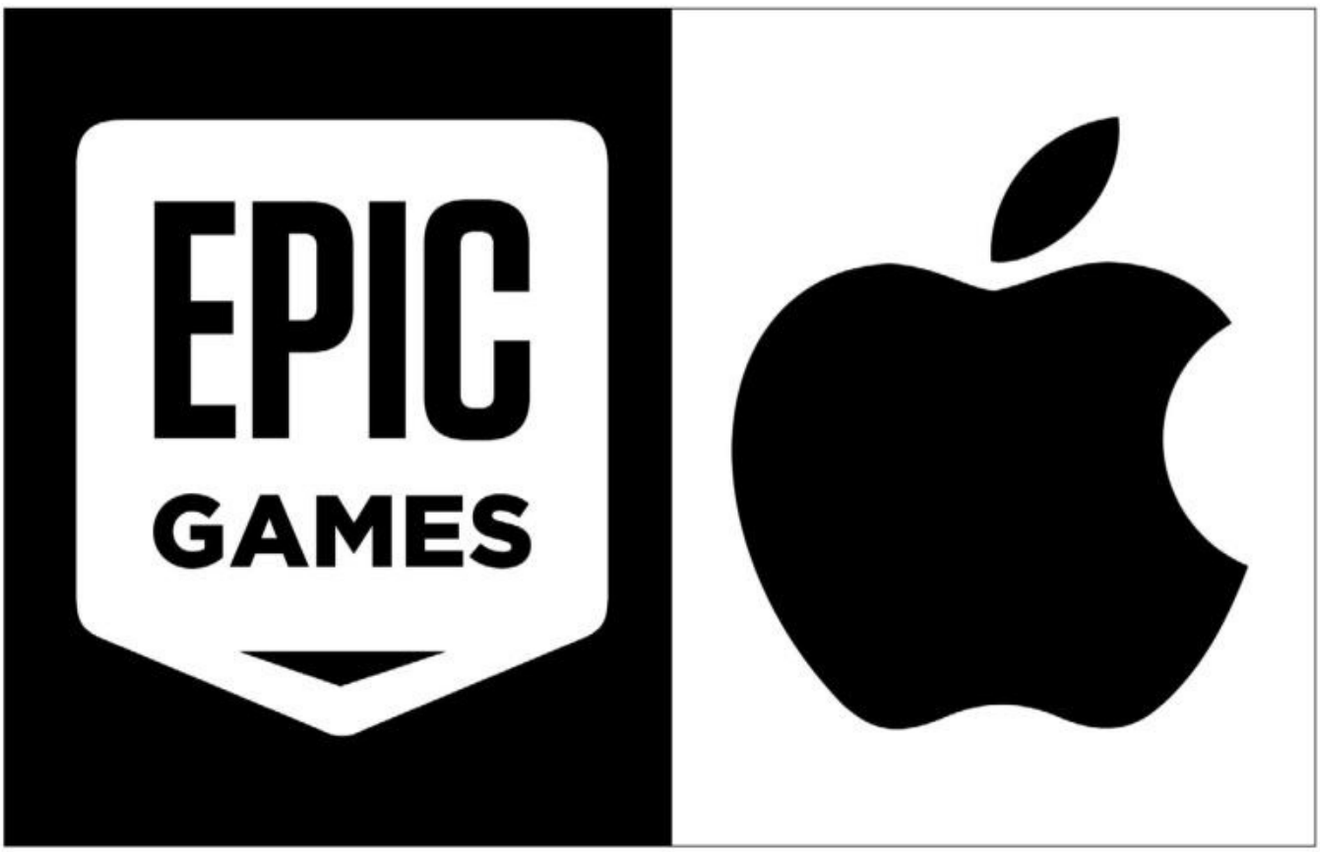
When Apple bought the scraps of Intel's modem business in 2019, it was just a matter of time before it started selling phones without Qualcomm modems. According to a new report, that time is rapidly approaching.

Japan-based Nikkei Asia reports that Apple has tapped TSMC to build the new modem, which will use 4nm chip production technology. The current modem in the iPhone 13, Qualcomm's X60, is built on a 5nm process. The report says production for new modem will begin in 2023.

According to the report, Apple is building the modem from the ground up with its own radio frequency and millimetre wave components as well as a custom power management chip, however, the first iteration might not be integrated into the processor. DigiTimes also reported that Apple's first 5G modem would be separate from the A17 and Nikkei Asia seemingly confirms that by saying the 2023 modem would "pave the way" to integrate the modem with the processor, suggesting that the first model will be separate.

A 5G modem built into the iPhone processor would be the first time Apple delivers an integrated module. The X60 modem is integrated in Qualcomm's Snapdragon 888 processor on high-end Android phones, but Apple uses it separately from the A15 processor in the iPhone 13. An integrated modem would provide power efficiency and space-saving benefits.

Apple signed a 'multi-year chipset supply agreement' when it settled its lawsuit with Qualcomm in 2019, which is primarily the 5G modem in the iPhone and iPad. However, Qualcomm announced at its earnings that it will only supply 20 per cent of iPhone modems by 2023, suggesting that Apple is indeed on track to deliver its own model by then.



Apple won't have to make any immediate App Store changes in Epic case

Until the appeals are all over, Apple will continue to operate the App Store as-is. **Jason Cross** reports

The seemingly never-ending saga of Apple versus Epic Games took another turn last month, as the Ninth Circuit Court of Appeals granted Apple a stay on a previous judge's ruling requiring it to make changes to its app developer rules for the App Store. The changes would have had to go in place on 9 December.

Apple was originally denied a stay in the anti-steering ruling that would

have required it to implement some method of allowing developers to link to an outside payment source from within an iPhone app. Apple argued that the fast turnaround didn't allow proper time "to protect consumers and safeguard its platform while the company works through the complex and rapidly evolving legal, technological, economic issues". An appeals court saw Apple's point and granted the stay. The basic rundown of events goes like this:

- Epic Games sued Apple over its rules for developers, claiming that the company violates many anti-trust laws in many ways and requesting the court remedy the situation by forcing Apple to treat the iPhone as it does the Mac – with its own app store, but other venues for app distribution and payments as well.
- The court ultimately decided that Apple wasn't a monopoly under the law, but did violate California law about anticompetitive behaviour. The judge ruled that Apple would have to allow developers to have links in their apps that take people out of the app store to manage accounts, which could include making payments outside the App Store. Apple had 90 days to implement the rules changes, which would have come into effect on 9 December. Both Apple and Epic have appealed the decision.
- Apple then asked for a stay on the judge's order, until the appeals are decided. Judge Rogers denied the stay, stating that Apple asked not for a specific limited amount of time, but for a blanket stay until the appeals are decided, which could take "years". Apple appealed that decision to the Ninth Circuit Court of Appeals.
- This brings us to the current decision. The Ninth Circuit wrote, "Apple has demonstrated, at minimum, that its appeal raises serious questions on the merits of the district court's determination," and has granted Apple the stay.

So now, Apple gets to keep operating its App Store as it wants to, and it will likely be a long time before it is required to make any changes as a result of the Epic versus Apple case. Epic CEO Tim Sweeney, who has repeatedly lashed out at Apple on Twitter and other public forums, says the appeal could be "as long as a 5-year process".

9:41
Just an incredible effort. I'll have a lot more to say tomorrow, but just wanted to tell you all how proud I am of your kids for how they all played today. We gave a great team all they could handle and nearly pulled it out. Thank you all for loaning your kids to me for a couple months.
Copy

Google's fix for ugly and annoying Android-iPhone chats is finally here

Michael liked this article. **Michael Simon** reports

If you've ever texted with an Android user, you know how conversations can quickly get overrun with 'Jason laughed at' this or 'Roman liked' that messages. As soon as an Android user joins a group conversation, Apple's iMessage reaction expressions turn to text prompts so no one misses out on what's happening.

That's changing thanks to the latest Google Messages update that's rolling out. According to 9to5Google, who previously dug through the APK for a

beta version (10.7) of the app's APK, the update is rolling to all users and completely changes the way Android phones interact with iMessages. According to the code, Google has changed expressions such as 'Liked', 'Emphasized' and 'Laughed' to 'ios_reaction_classification' and 'Show iPhone reactions as emoji' as well as 'ios_reactions_mapping'.

That means reactions won't appear as text anymore and will look very similar to iMessage reactions. For example, 'liked' messages will be tagged with thumbs-up emoji and won't need to repeat the entire message anymore. The appropriate emoji will appear under the original message rather than above it, but otherwise it's very similar to how it works with iPhone users. At the time of writing, the Google Messages update hadn't appeared on our Pixel phone yet, but it's expected soon.

Razer has made a giant MagSafe fan with RGB lights because it can

Cool, cool. **Michael Simon** reports

While Apple may design its chips so cooling fans are largely unnecessary, Razer thinks the iPhone still needs one. A big one. With lights!

For £60, you can now buy a MagSafe-compatible Razer Phone Cooler Chroma that attaches to the back of your iPhone to add a seven-blade fan with up to 6,400rpm and RGB lighting. Razer supplied Macworld with tech specs for the device and it's quite large, measuring 65.8mm in diameter and 24.1mm deep.

Razer says the Phone Cooler's "electronic Peltier cooling tile with heat sink draws heat away from your smartphone and dissipates it with a powerful yet quiet seven-blade fan, ensuring maximum airflow with minimal noise". It adds that the fan's noise profile is just 30 decibels, which is pretty quiet. But since it's literally attached to your phone, you'll probably still hear it. And you'll need to stay close to an outlet when using it because it needs to be plugged in to operate, according to Razer.

The Razer Phone Cooler Chroma attaches to the back of your iPhone 12 or 13 using MagSafe.

While the cooler attaches to your iPhone using MagSafe, in this instance it just means magnets. There are no special MagSafe-powered abilities. It also has a USB-C port for what Razer calls "fast, convenient power while you game", but, like the iPhone, it doesn't come with a power adapter. It also won't charge your iPhone while you use it, but you will be able to 'unleash brighter, more refined lighting effects for greater style and gaming immersion'. That's thanks to a 12-RGB LED for 'maximum flair'.

We're pretty sure this wasn't Apple's intention when it launched MagSafe, but it's certainly a unique accessory that's far better than the Android version which uses a clunky clamp to stay in place. It's shipping now, so if your iPhone is running too hot or you want a splash of colour, head over to Razer to buy one – visit fave.co/31XNhri.

Once more for the people in the back: iPhone sales are just fine

Another year, another report of production cuts that spell doom for Apple's flagship product. **Michael Simon** reports

Barely a week after Apple sold more devices than we can possibly count over the Black Friday-Cyber Monday frenzy, Bloomberg started spreading gloom and doom regarding iPhone sales. According to the publication's sources, Apple had alerted suppliers that demand for the iPhone 13 had weakened heading into 2022. As usual, any Apple report is headline-grabbing news, especially if it's

negative. But also as usual, these reports should be taken with a grain of salt. I'm not doubting the veracity of Bloomberg's "people familiar with the matter", but it's something like a supply-chain version of telephone. Every year about this time someone writes an article about how iPhones sales are slumping because Apple is chopping orders.

The iPhone 13 is reportedly suffering 'weakened' demand.

I'm quite sure that Apple is indeed warning that it may need to cut January orders, as Bloomberg reported. After months of supply chain issues that took a $6 billion toll on Apple's fourth-quarter revenue, Apple was expected to have a weeks-long backlog of iPhone demand that stretched into January. Bloomberg reports that Apple "is now informing its vendors that those orders may not materialize" due to "weakened" demand. In a nutshell, the report says that now that people can buy iPhones, no one wants them anymore.

There are numerous reasons why that might be the case. The easiest explanation is that Apple overestimated the demand for the iPhone 13. While it's an excellent phone, it's not a huge upgrade over the iPhone 12, which introduced a new design and 5G, so some buyers might opt for 2020's phone instead and save a few pounds.

There's also evidence that Apple shifted production to get more iPhones into more hands. While these are currently shipping about a week out on Apple.com/uk, the ninth-generation iPad, iPad Air and iPad mini are basically sold out everywhere. While it could be that those two products are the most popular devices Apple currently sells, it's more likely the company

sacrificed iPad production to make as many iPhone 13 handsets as possible.

Finally, yes it's possible that a bunch of expected upgraders might have decided to sit this one out, especially since rumours of the iPhone 14 are already setting it up as a big upgrade.

But none of these things add up to doom or gloom. iPhone sales aren't just going to fall off a cliff one day. It might have looked that way in 2019 when iPhone sales fell by an uncharacteristic amount, but Apple responded with the iPhone 11, SE and 12, and everything was fine. And besides, it's hard to believe that iPhones were in such demand in the autumn that Apple wasn't able to fulfil orders until January and now that they can get them people don't want them.

While it's true that the iPhone isn't as backlogged as we had originally feared and Apple is likely cutting back on some January orders, it's probably not due to flagging demand. The truth is likely somewhere in the middle: Apple sold more iPhones than it expected over the past two months due to Tim Cook's expertise in supply chain management but not before some people who couldn't get the iPhone 13 decided to just buy an iPhone 12 instead.

Apple is going to make a ton of money this quarter, almost certainly more than any other quarter in its history. And it'll probably leave some money on the table due to the supply crunch. But there's nothing to worry about.

5 things I learned by switching from the iPhone 12 mini to the 13 Pro Max

A matter of size. **Michael Simon** reports

Over the years, I've used iPhones of all sizes. My first smartphone was the original 3.5in iPhone, and I've carried every size screen at some point – the 4in iPhone 5s, the 4.7in iPhone 6s, the 5.5in iPhone 7 Plus, the 5.8in iPhone X, the 6.1in iPhone 11, and most recently, the 5.4in iPhone 12 mini.

So when the iPhone 13 launched, I naturally ordered the one missing

from that list: the 6.7in iPhone 13 Pro Max. That's a full 1.3 inches bigger than the iPhone 12 mini that I've been using for the past 11 months, so it definitely took some getting used to. But along with the size and the weight – both not insignificant hurdles to overcome – I've learned some surprising things about the differences between Apple's smallest and biggest iPhones.

PHONES CAN LAST ALL DAY

This one might seem obvious, but until the iPhone 13 Pro Max, I had never used an iPhone that consistently lasted all day. With the iPhone 12 mini, I regularly kept a charger nearby just to ensure that I didn't run out of juice. That's not even the slightest concern with the iPhone 13 Pro Max. Between the bigger battery, A15 power handling advancements, and the adaptive refresh display, the iPhone 13 Pro Max is a battery beast, easily getting through a day of extremely heavy use without dipping into the red. With conservative use, I could probably get through a full weekend without a charger. It's the single biggest reason why I would recommend the Max to anyone buying an iPhone.

STAINLESS STEEL IS PRETTY IN RENDERS BUT IMPRACTICAL

Since the iPhone 13 Pro has an identical design to the iPhone 13, Apple needs to distinguish it in some way, so it opted to wrap it in stainless steel rather than aluminium, which looks incredible in renders but isn't all that great in practice. It's heavy, it scratches easily, collects smudges, and quite frankly, doesn't look better than the brightly coloured aluminium on the iPhone 13. I understand why

The iPhone 13 Pro Max (left) isn't just bigger than the iPhone 13 and the iPhone 12 mini, it also lasts much longer.

The iPhone 13 Pro Max should take some cues from iPadOS.

Apple would use a different material for its higher-end phones, but I'm hoping the rumours of titanium for this year's Pro models are true.

iOS SHOULD CATER TO LARGER SCREENS

Obviously, the iPhone 13 Pro Max is substantially bigger than the iPhone 12 mini, but other than the physical size of the screen, you're not giving up all that much between the two phones. The usual Pro-to-non-Pro differences apply – better camera, better display, better battery – but for normal tasks, the Max doesn't really offer all that much over the mini. Unlike the Apple Watch Series 7, which offers enhanced UI elements to take advantage of the larger screen, the iPhone Max has the exact same interface as the iPhone mini.

That means to say you're getting the same icon grid, widgets, dock, and App Library. The iPhone 13 Pro Max could easily fit an extra row of icons, but Apple instead has a large swatch of blank space at the bottom of the Home Screen. The same goes for the Dock, which could fit a fifth icon if Apple wanted. So the only things you're giving up with the mini are larger photos and a couple of extra lines of text. Apple should take a page from the Apple Watch Series 7 here and retool iOS to take advantage of the extra space.

THE MAX NEEDS APPLE PENCIL SUPPORT

You don't need me to tell you that the iPhone 13 Pro Max is an extremely

large phone. With a 6.7in screen, its display is only about an inch smaller than the original iPad mini. A display that big is great for watching movies, but it's also an excellent productivity device for things like typing long emails and editing photos. But you still have to use your fingers for everything.

The Apple Pencil is a fantastic accessory for the iPad, and it would be just as valuable on the iPhone 13 Max. With a 6.7in display, it's about the size of a small notebook, and a smaller Apple Pencil would be a perfect way to use it as a way to quickly just down thoughts and mark up documents. And what's more, it would separate the iPhone 13 Max from the rest of the line-up and establish it as more of a pro productivity device, like the iPad Pro or Samsung Galaxy Note.

THE MINI IPHONE DESERVES A PLACE IN APPLE'S LINE-UP

There have been numerous reports to suggest that the iPhone 13 mini will be the last of its kind. Poor sales have seemingly deemed the tiniest iPhone for the chopping block as iPhone buyers gravitate toward handsets with larger screens. While I certainly appreciate the iPhone Max's 6.7in display, I also miss the one-handed use of the iPhone 12 mini.

If the iPhone mini really is going away with the iPhone 14 line-up, I hope Apple keeps it around with a future iPhone SE. After all, Apple currently sells the 12 mini for £579 and will presumably cut it down to £489 next year like the current iPhone 11. While rumours suggest the 2022 iPhone SE will stick with the same retro design, the next, next model is almost certain to adopt a Liquid Retina display and the iPhone mini chassis would be a perfect fit.

The iPhone was this close to being an exclusive Xbox handheld gaming system

Emails show serious negotiations between Apple and Microsoft. **Michael Simon** reports

We've heard a lot of stories over the past few months about how protective Apple is of its App Store guidelines and, more importantly, commission, but this one might take the cake. According to a series of emails disclosed as part of the Epic Games trial, Microsoft was willing to bring exclusive triple-A Xbox games to the iOS App Store before talks fell apart.

It's all very tantalizingly close to what Xbox gamers have wanted for years: a powerful handheld gaming system that doesn't need to be tied down to a console. The email correspondence between Microsoft Xbox head of business development Lori Wright and members of Apple's App Store teams show that Microsoft was eager to get Xbox games through individual apps on the iPhone rather than the browser-based xBox Cloud Gaming Cloud service available now.

There were several sticking points along the way. For one, Microsoft wanted a "single streaming tech app" that ran the games, but Apple pushed to include the streaming tech inside each individual game so users wouldn't have to download a separate app. Microsoft argued that a core streaming app would "be a better experience for users" due to smaller game downloads and less frequent updates, but Apple was adamant. In-app purchases were also a major sticking point, as Microsoft did not want to use Apple's in-app purchase system as required by the App Store terms.

The emails are a remarkable look at the inner workings of the App Store and also how massive the iPhone could be as a gaming platform. Microsoft was seemingly willing to offer quite a bit in the way of exclusives that aren't available in Game Pass to get past Apple's walled garden. Xbox Cloud Gaming CVP Kareem Choudhry told the Verge in no uncertain terms: "In addition to Xbox Game Pass, we were also open to bringing select individual games to iOS as we do today with titles like Minecraft."

That would have given the iPhone an incredible edge over Android when it comes to gaming, but ultimately Apple's rigid App Store terms were too big to overcome. But hey, at least we can still play Halo Infinite through xCloud on our iPhones – with a browser, strong Internet connection and a Game Pass Ultimate subscription. So close, yet so far.

Best iPhone 2022: Which model is right for you?

There are more new iPhones than ever before – we'll help you choose the right one. **Karen Haslam** reports

In September ,we saw the unveiling of four new iPhone handsets: the 13, 13 mini, 13 Pro and 13 Pro Max. Those new handsets joined the iPhone 12, 12 mini, 11 and SE, all of which are still available. With eight different iPhones to choose from there is something for everyone, but which iPhone is the best?

For many diehard fans the obvious choice is the most recent iPhone with the best specs. But many people simply don't need – or can't afford – the most expensive model. So you

must think about what matters. What's your budget? How large a screen do you want and need? Are you happy with a single-lens camera on the back, or is it worth paying extra for twin or triple lenses?

We've racked our brains to rank the iPhones from best to worst for the average buyer, taking into consideration age, size, price (on contract or SIM-free), performance, battery life and more.

BEST OVERALL: iPHONE 13 PRO

Price: £949 from fave.co/2Y377Qk

Early in the 2021 iPhone rumour life cycle, it was reported that Apple might call this year's offering the iPhone 12s. Previous 'S' model iPhones – such as the iPhone 6s or iPhone Xs – would generally keep the same design and features of the previous year's model, with a faster processor, better camera, and a single standout new feature.

Though Apple didn't go with iPhone 12s name, it may have been a fitting monicker, at least where the Pro models are concerned. The iPhone 13 Pro is essentially the 12 Pro with a faster processor, better camera, and one big standout feature (ProMotion).

But to treat it so reductively is to do it a disservice. The scale of improvements here are noteworthy, and the gap between Pro and non-Pro models is significant. This is essentially the iPhone 12 Pro with ProMotion, a better camera system, faster performance, and better battery life. That's not a surprising or particularly innovative set of improvements, but it still adds up to one hell of a nice iPhone.

The iPhone 13 Pro is our top pick.

Sierra Blue is a lot brighter than Pacific Blue, and just look at that huge camera bump.

Refined design

While the iPhone 13 Pro looks a lot like the 12 Pro at a glance, and indeed is a sort of fraternal twin, there are differences. Some are subtle, others jump right out at you.

The iPhone 13 Pro and Pro Max are nearly the exact same physical dimensions as the 12 Pro models they replace. These are heavy phones, just as their predecessors were; a natural side-effect of the stainless steel frame.

Not much has changed when it comes to durability, not that we're complaining. The iPhone 13 Pro still carries an IP68 water and dust resistance rating, and is rated for up to 30 minutes at a depth of six meters. It's got the same Ceramic Shield front glass, too.

The silver, graphite, and gold colours from last year return, but Pacific Blue has been replaced with Sierra Blue, a much lighter shade that looks nice enough, though I prefer last year's darker hue.

While USB-C is creeping its way through all of Apple's other products – it's now the only port on MacBooks, the M1 iMac, iPad Pros, the iPad Air, and iPad mini – the company still refuses to move the iPhone line to this more universal plug. If you have a bunch of Apple gear, you have Lightning and USB-C charging cables. And for no good reason, really. Come on, Apple. It's time.

Speaking of charging, there's not much new there. You still get a USB-C to Lightning cable in the box but no power adapter or headphones. Charging performance is unchanged: you get up to 50 per cent charge in 30 minutes with a 20-watt USB-C adapter.

Sure the notch is smaller on the iPhone 13 Pro (right), but without changing the status bar, what's the point?

Storage options still start at 128GB, with options for 256GB, 512GB, and now a new 1TB option. That's an obscene amount of storage for a phone and really only worthwhile if you think you're going to shoot a lot of video (especially in ProRes format).

The design changes you will notice right away are the smaller notch and much bigger camera module. The rear camera area is dramatically larger and sticks out further, to the point where you might not actually be able to put your phone on some stands or car mounts without a case that makes the camera bump sit flush. Note that most of Apple's first-party cases do not.

The notch on the front where the speaker and TrueDepth sensors reside is now 20 per cent narrower, which is nice, but the extra screen space is going entirely to waste. You don't get any additional icons or information in the status bar. Surely Apple must know that everyone wants the battery percentage back, right?

This year, the iPhone 13 Pro and Pro Max have the exact same camera system and software features, so you don't have to buy the bigger one to get the better camera. This is the right approach, and we hope Apple continues it in the future.

ProMotion comes to iPhone

The first thing you'll notice when you pick up an iPhone 13 Pro is just how smooth everything feels. Swipes, scrolls, interface animations...Apple was always good at this stuff, but the responsiveness and smoothness of the iPhone 13 Pro is on another level.

That's thanks to a new OLED display that is more power efficient

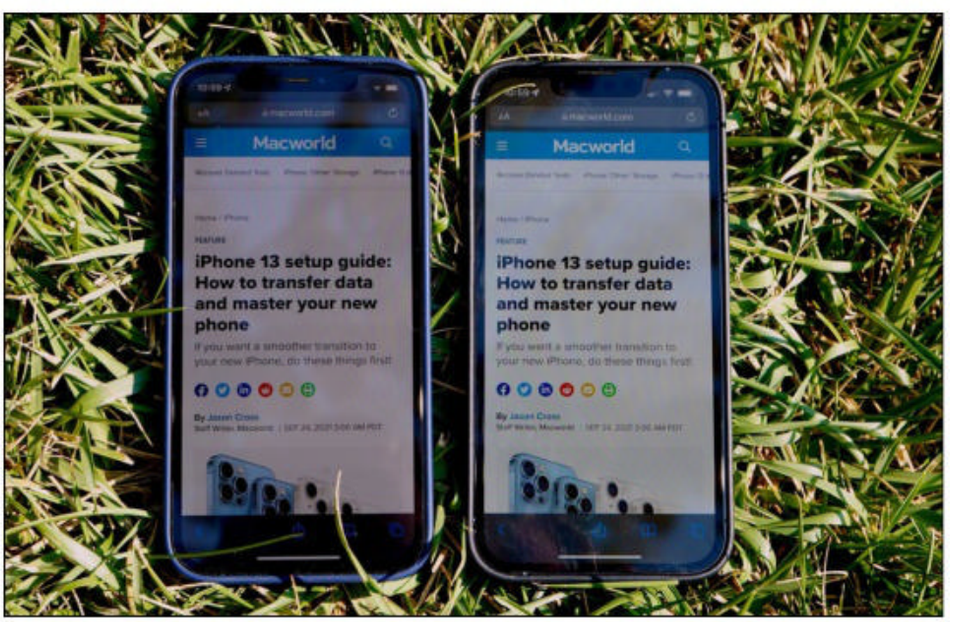
and includes ProMotion technology similar to that found on the iPad Pro. Rather than always refreshing at 60Hz, the display can go as low as 10Hz and as high as 120Hz.

There are no settings for this; the phone continually adjusts the display refresh based on the content on screen. Play back a 24fps movie and the display will lock to 24Hz. Read static text and it'll drop to 10Hz. Start scrolling and swiping around and it'll ramp up to 120Hz.

Many apps that use standard iOS frameworks for scrolling and full-screen transitions will automatically take advantage of this, looking and feeling smoother as a result. Apps like games will require an update to take advantage of ProMotion, and there are currently some limitations there that don't exist for iPad developers and will hopefully be lifted in future software updates.

The upshot of all this is that the display is smoother and faster when it matters most and more power efficient the rest of the time. This has an overall positive impact on battery life, which we'll get to later.

The display is brighter, too: it goes up to 1,000 nits in standard use, up from 800 on the iPhone 12 Pro (the max is still 1,200 nits for HDR content). We've had some very bright and hot days here in Sacramento lately and you can clearly see the difference out in direct sunlight. In other circumstances, the screen looks just like the excellent iPhone 12 Pro display.


Macworld
iPhone 13 setup guide: How to transfer data and master your new phone
Macworld
iPhone 13 setup guide: How to transfer data and master your new phone

In bright sunlight, the brighter display of the iPhone 13 Pro (right) makes it easier to read.

Enthusiasts have been begging for ProMotion on the iPhone ever since it landed on the iPad Pro four years ago. It's just as good as we've always expected, and a

clear differentiator between the Pro and standard iPhone 13. Now it just needs to come to the MacBook Pro and iMac.

The fastest smartphone money can buy

The A14 found in last year's iPhone 12 is faster than any processor found today in any Android smartphone. No Qualcomm Snapdragon or Samsung Exynos can come close to last year's best chip from Apple.

And now the A15 is faster. In some ways, much faster. Like the A14, the A15 is made with a 5nm manufacturing process from TSMC, and still sports two high-performance cores and four high-efficiency cores. Nonetheless, in our benchmark tests we found the A15 delivers about 8- to 10 per cent faster single-core CPU performance, and 15- to 20 per cent better multi-core CPU performance.

Geekbench 5

iPhone 13 Pro: 1,740
iPhone 13: 1,728
iPhone 12 Pro: 1,601
iPhone 11 Pro: 1,333
iPhone XS: 1,107

The GPU is where things get really interesting. In the iPhone 13 and iPhone 13 mini, the A15 still has a four-core GPU. In the iPhone 13 Pro and Pro Max, however, it's got a fifth core. That 25 per cent increase in GPU cores makes it around 20- to 30 per cent faster than the iPhone 13, and 40- to 50 per cent faster than the iPhone 12 when it comes to 3D graphics and GPU compute tasks.

3DMark Wild Life

iPhone 13 Pro: 9,734
iPhone 13: 9,122
iPhone 12 Pro: 7,971
iPhone 11 Pro: 7,259
iPhone XS: 5,734

Put another way: the A15 with a four-core GPU cores delivers performance around 10- to 15 per cent higher than the four-core GPU in the A14, and the A15 with a fifth core is 20- to 30 per cent faster than that. It really separates the iPhone 13 from the iPhone 13 Pro.

Apple has made other improvements, too. There are power efficiency tweaks across the board, including in stuff like wireless radios. The image signal processor is upgraded, as is the video encoder and decoder (we hope it supports AV1). The Neural Engine has 16 cores, just like that in the A14, but it can

do almost 16 trillion operations per second, up from 11 trillion.

Will you even notice all this speed? For most of the things you use your iPhone for, no. When last year's processor is faster than the competition and this-year's processor is even faster, what do you even do with that? Most people use their phones for things like web browsing, email, texting, and apps that essentially scroll lists of images and text (Twitter, Instagram, Facebook). A ProMotion display helps with all that, but a faster processor doesn't necessarily make much difference.

It will probably be a few years before the applications and iOS features that really push the A15 are commonplace. All this performance is as much about longevity as it is about making your life better today.

Crazy-good battery life

The case for more smartphone performance can sometimes be hard to make. Millions of people use phones that are two or three years old and think they're plenty fast for everything they do. If they need a new phone, they're more concerned with it being affordable than it being a lot faster.

But ask anyone, anywhere, with any smartphone, if they want longer battery life, and answer is yes. Yes, of course yes, always yes.

Consider, then, that the iPhone 13 Pro gives you both. It's fast enough to embarrass every other smartphone, and it lasts way longer than previous models. To start with, Apple simply put higher-capacity batteries in the entire iPhone 13 line. While the company doesn't disclose specifics, regulatory filings show that the iPhone 13 Pro has a battery with about 11 per cent more capacity than the iPhone 12 Pro, and the iPhone 13 Pro Max's battery holds around 18 per cent more charge.

The non-Pro iPhone 13 models have larger batteries as well, but they don't have the more efficient LPTO OLED display nor ProMotion, which is a battery saver. Just as running the display at 120Hz eats through your battery faster, running it below 60Hz will conserve it.

The results are phenomenal. We run our battery test with the display set to a constant 200 nits while looping the Geekbench 4 battery rundown test, which puts significant strain on the CPU and GPU. The iPhone 13 Pro lasted 9 hours, 15 minutes, an impressive 35 per cent longer than the 12 Pro. It's even longer than the iPhone 12 Pro Max (8 hours, 41 minutes),

Geekbench 4 battery test

iPhone 13 Pro: 555
iPhone 13: 491
iPhone 12 Pro: 412
iPhone 11 Pro: 362
iPhone XS: 264

My regular daily use has me just as impressed and the benchmarks. At the point where my iPhone 12 Pro would hit 20 per cent and flash the low battery warning, the iPhone 13 Pro often shows 40 per cent or more remaining. It's extremely difficult to do an accurate comparison of real-world use, but I estimate that I'm getting about two hours more screen-on time.

If you're coming from an older iPhone, you're going to be shocked at how long the battery lasts. The iPhone 13 Pro is a big step up from the iPhone 12, but Apple has been steadily marching forward with battery life for years. The iPhone 13 Pro lasts about 50 per cent longer than the iPhone 11, and twice as long as the iPhone Xs introduced just three years ago.

A much better camera

The iPhone 13 Pro has an improved camera system, because of course it does. Every new iPhone does. The iPhone 13 Pro brings significant improvements to both camera hardware and software processing.

On the hardware side, there are all new sensors. You'll notice the huge camera bump on the back, far larger than that on the iPhone 12 Pro. That's your first clue that things have changed a lot.

The telephoto camera has been

The iPhone 13's 3x telephoto (right) gets you a lot closer, and produces more natural portraits.

increased from 2x to 3x, or an equivalent focal length of 77mm. That means the aperture narrows from f/2.0 to f/2.8 and you lose a bit of low light performance, but it's a great change overall. It means better portraits with a nicer natural bokeh, rather than the fake bokeh of Portrait Mode on the iPhone 13. It gets you closer to distant subjects more naturally, without grainy digital zoom. And that slightly worse low light performance is partially negated by the fact that you can now shoot Night Mode shots with the telephoto camera.

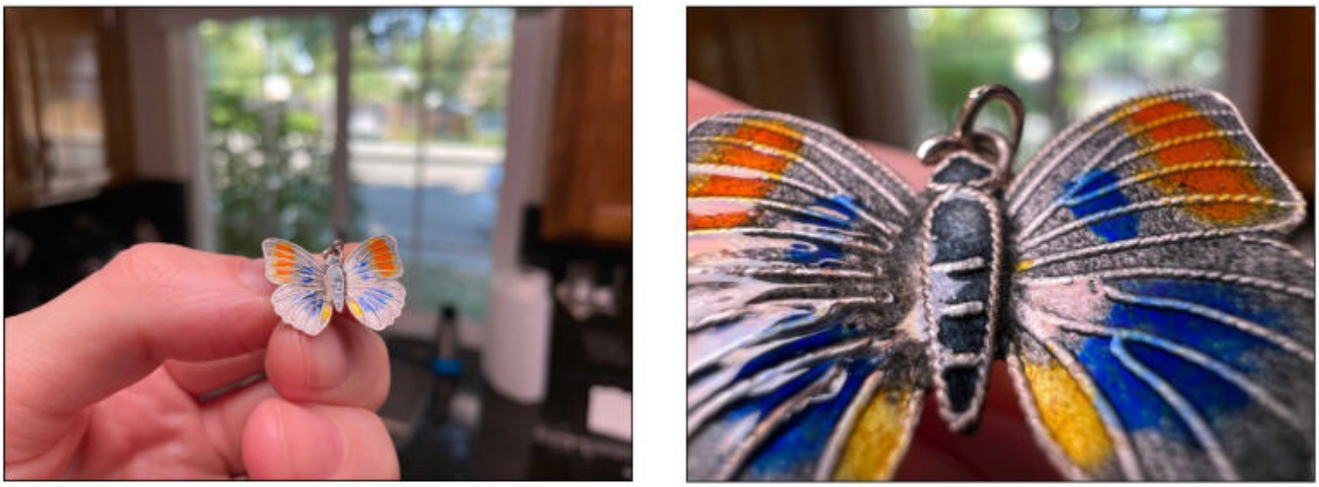
The 'sweet spot' for professional portrait photography is generally in the 85-105mm focal length range, so this new 77mm 3x telephoto lens gets us much closer to that flattering perspective.

The standard wide camera, where most people do most of their shooting, now has a much larger sensor. The resolution is still 12 megapixels, but the pixels are bigger at 1.9 microns and the aperture is a wider f/1.5. Apple says it captures 2.2x more light, and while I can't attest to that, I've noticed it does a better job with detail and colour in low light, and seems to sometimes take Night Mode shots more quickly.

The Ultra-Wide camera has a wider f/1.8 aperture and performs better in low light, but the real trick is how well it focuses up close for macro shots. Move any other iPhone closer than about 4 inches from your subject and it becomes a blurry mess, but the iPhone 13 Pro takes macro shots with ease. The minimum focal distance for the Ultra-Wide camera is only two centimetres, so you can push the camera right up close to that flower, bug, jewellery, or miniature.

In Photo mode, the camera automatically shifts to Ultra-Wide when you get up close, while tying to maintain relative framing. Macro shots work in video too, even slo-mo, but you have to switch to the Ultra-Wide manually.

Macro shots aren't a specific mode, just a natural capability of the Ultra-Wide camera, so there's nothing to set or enable (though Apple says it will add an option to manually switch it out it in a future iOS 15 update). Just push your iPhone way up close and get detailed shots like never before. This is one of those things that tons of people will make use of, all the time. It was a big limitation of smartphones in general, and it requires no special knowledge or settings to use. It's also only on the iPhone 13 Pro models –



The minimum focus distance of the iPhone 12 Pro (left) doesn't come close to the iPhone 13 Pro (right).

the ultra-wide camera on the regular iPhone 13 doesn't have the super-tight focal distance.

For a few years now, the "Pro' model iPhones have been the only place to get a telephoto camera and the main differentiator. But with the tighter 77mm zoom, the larger Wide sensor, and the Ultra-Wide's wider aperture and macro capability, the camera system on the iPhone 13 Pro even further separates it from the iPhone 13.

Once again, the Pro models come with LiDAR and the non-Pro models don't. This helps AR apps perform better and provides quicker and more accurate autofocus in poor lighting conditions, plus enabled Portrait Mode and Night Mode at the same time. It's disappointing that

The selfie camera is perfectly fine, but it hasn't really changed since the iPhone 11.

Apple still hasn't done anything really impressive or groundbreaking with LiDAR yet.

The front camera has not changed. It's the same 12Mp, f/2.2 selfie camera you'll find on the iPhone 12. You get the better image processing, can use Photographic Styles, and can shoot in Cinematic mode, but the hardware hasn't changed at all.

New photo and video tricks

Photographic Styles? Cinematic mode? Yes, the improved image processor in the A15 enables better image processing (Apple calls it Smart HDR 4) but the iPhone 13 has picked up a couple new software tricks as well.

Tap the little down arrow in the Camera app to show adjustment controls, and you'll find a new one: Photographic Styles. Swipe to change the style between Standard, Rich Contrast, Vibrant, Warm, and Cool styles. You can further customize the warmth and tone within each style.

Apple is careful to note that this isn't simply a filter. Instead of a constant change applied evenly to an entire image, the style is part of the complex computational photography steps that produce your final image from multiple exposures. It's applied differently to different parts of the scene, so a more vibrant style might make the sky more blue, but it won't create an unnatural cartoon skin tone.

Just choose one you like, tweak it you suit you, and it will be applied to all your images even after you close and reopen the Camera app. I think this is a feature everyone can appreciate. If you find the iPhone's camera produces cold and sterile whites, you can warm them up. If you like the punchier colours of Samsung's cameras, you can imitate that. You can create a 'default' camera experience that suits you, with results that are more natural than a standard filter.

Cinematic mode is maybe less useful for your average iPhone user. It's a whole new video mode that shoots at 1080p and 30 frames per second in Dolby Vision HDR, and requires a decent amount of light to work (you'll get a warning if you try to shoot where it's too dark). In this mode, the iPhone 13 will use AI to identify the subject in your video in order to automatically perform 'focus pulling'.

That's a cinematic term for changing the focus throughout a shot to keep a subject in focus, or two switch focus between the foreground

You don't have to inspect the iPhone 13 Pro to see how much bigger the camera array is.

and background. It's such a common technique in film and TV that you probably don't even really recognize it's happening. Cinematic mode does this automatically, and works surprisingly well, and the metadata for the focal distance is saved with the video so you can go back in later to adjust focus targets as you edit.

Currently, Cinematic mode videos have to be edited on an iPhone, but support is coming to iMovie and Final Cut Pro later this year. And if you AirDrop the video or send it in an iMessage or whatever, your focus options will be baked into a standard video file format.

It's a fun mode to play around with, but the lack of support in third-party video editing software and the limited resolution and frame rate make it more of a toy than a serious tool. It's going to be a big hit for TikTok stars and others who create smartphone-centric video designed for social media, but your average user is probably better off shooting regular video in 4K for now.

Both Photographic Styles and Cinematic mode are also found in the regular iPhone 13, but the iPhone 13 Pro does get one exclusive new video feature: the ability to shoot directly in the ProRes video format, after a software update later this year. ProRes is what they call an 'intermediate format' meant for video editing, intended to preserve the best quality through the edit pipeline at the expense of huge file sizes. It's not meant as a way to actually consume or distribute video, so if you're not a video editor who already works in ProRes you shouldn't concern yourself with it. ProRes will be limited to 4K at 30fps, except on the 128GB iPhone 13 Pro where it will

be limited to 1080p.

Shooting photos in the ProRAW format is still limited to the iPhone 13 Pro and Pro Max, just as it was limited to the iPhone 12 Pro models.

Verdict

I can't really tell what Apple means by 'Pro' these days. The Mac Pro, iMac Pro, Pro Display XDR, and MacBook Pro seem aimed at actual professionals – those who use the device for the work they do and have specific performance and feature requirements. The AirPods Pro, on the other hand, are just the better AirPods. I don't think even Apple would claim they deliver the fidelity needed for professional audio work.

The iPhone 'Pro' models lie somewhere in-between. A 1TB storage option is definitely a Pro feature, as is the ability to shoot ProRAW photos and ProRes video. Most consumers shouldn't care about that stuff. On the other hand, features like the ProMotion display would be appreciated by everyone, especially since it improves battery life. Pros aren't the only ones who want a telephoto camera, and they definitely aren't the only ones who want to take macro photos.

Whatever meaning of 'Pro' you ascribe to this particular Apple product, it's unsurprisingly the best iPhone yet and one of the best smartphones money can buy. We have nits to pick: It's time for the selfie camera to get an upgrade, Apple needs to embrace USB-C on iPhone, we still want an always-on display mode, and that enormous camera bump might cause minor issues with a few stands and mounts. But a product doesn't have to be flawless to be the best, and that's exactly what this is. **Jason Cross**

Specifications

- 6.1in (2,532x1,170; 460ppi) Super Retina XDR OLED display
- iOS 15
- Apple A15 Bionic (5nm) processor
- Hexa-core (2x 3.22GHz Avalanche, 4x Blizzard) CPU
- Apple GPU (4-core graphics)
- 6GB RAM
- 128GB/256GB/512GB/1TB storage
- Four rear-facing cameras: 12Mp, f/1.5, 26mm (wide), 1.9µm, dual pixel PDAF, sensor-shift OIS; 12Mp, f/2.8, 77mm (telephoto), PDAF, OIS, 3x optical zoom; 12Mp, f/1.8, 13mm, 120-degree (ultra-wide), PDAF; TOF 3D LiDAR scanner (depth)
- Dual selfie cameras: 12Mp, f/2.2, 23mm (wide), 1/3.6in; SL 3D,

(depth/biometrics sensor)
- Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS, GALILEO, BDS, QZSS
- NFC
- Lightning, USB 2.0
- Face ID
- Non-removable 3,095mAh lithium-ion battery
- Fast charging 20 watts
- 146.7x71.5x7.7mm
- 204g

BEST FOR MOST PEOPLE: iPHONE 13

Price: £779 from fave.co/2XIWHVX

If not for the arrangement of the cameras, the iPhone 13 would be nearly impossible to distinguish from the iPhone 12. There are other subtle differences – it's a hair thicker, the volume and side buttons are lower, the notch is smaller, and the colours are a bit more subdued – but the main differentiator is the diagonal placement of the rear camera lenses.

Like everything about the iPhone 13, that subtle change is more meaningful than it seems. You get the same wide and ultra-wide camera system as on the iPhone 12, but the diagonal placement is necessary to accommodate an advanced camera system. It's a classic Apple upgrade – seemingly superfluous on the outside but hiding bigger things on the inside.

The iPhone 13 will garner its share of annual buyers, but it isn't an essential upgrade for anyone using an iPhone 12 or maybe even an iPhone 11. But that's not really who it's meant for. The iPhone 13 is the phone for the millions of Apple users who skipped the iPhone 12 and maybe even the iPhone 11 and will be perfectly happy with their vertically aligned cameras for another 12 months.

A familiar face

On the surface, the iPhone 13 looks nearly identical to the iPhone 12. The screen is the same – 6.1 inches – and the dimensions are very close, with the exception of the thickness (7.65mm versus 7.4mm) which is difficult to discern even when comparing the phones side-by-side. The other physical differences are the aforementioned diagonal camera array, and slightly lower volume and side buttons.

At 174g, the iPhone 13 is also a touch heavier than the iPhone 12 (162g). There are a number of reasons why – bigger battery, larger cameras, thicker frame – but the fact is it's one

The iPhone 13 is a great phone with a great screen and a great camera – it's just not that much greater than the iPhone 12.

of the heaviest phones this side of the iPhone 13 Pro, which is 41g heavier.

You'll need to turn the display on to see the biggest visual change: a smaller notch for the front camera and sensors. Apple has reduced the size of the iPhone's most iconic characteristic by roughly 20 per cent and it's definitely smaller. Also, the earpiece speaker has been shifted to the top edge of the phone making it a bit less distracting.

However, the smaller notch doesn't really add anything other than a few extra pixels for the 'horns' on either side of it. Instead of adding a new status icon, Apple has merely centred the existing icons, which is somewhat more distracting since there's a bit of dead space around them now. I'm hopeful that an iOS update will bring new icons or a toggle to show battery percentage because it's a shame that Apple isn't embracing the extra space.

Aside from the notch and a higher max brightness (800 nits versus 625 nits), the rest of the screen is essentially the same as the iPhone 12, a 6.1in 2,532x1,170 Retina display with True Tone, wide colour, and Haptic Touch. The bezels around the display are the same as well, and they're starting to show their age. Apple calls it an "all-screen OLED display", but it has a much lower screen-to-body ratio than many of its Android peers. The iPhone 14 is rumoured to bring a new design, so hopefully, Apple has thinner bezels in the works.

The iPhone 13's notch is noticeably smaller, but the extra space doesn't add much.

Notably, the iPhone 13 has the same 60Hz display as previous iPhones, in contrast to the iPhone 13 Pro's new ProMotion variable-refresh 120Hz display. It's a notable difference when moving between the two models, but not one the previous iPhone users will notice. ProMotion is definitely better, but the standard old iPhone display is pretty good too.

Blow-away battery life

Like every other iPhone Apple has ever released, the iPhone 13 has Apple's latest A-series processor, the A15 Bionic. But unlike previous years, the iPhone 13's processor is slightly less capable than the one in the iPhone 13 Pro.

That probably won't be an issue for all but the most discerning of users. In benchmarks, the iPhone 13 and iPhone 13 Pro are roughly 20 per cent apart in graphics tests and basically identical in CPU performance. They're both still way faster than the iPhone 12 and enormously capable, but if you're a high-end gamer or a real power user, the extra graphics core might make an impact. For most users, the standard A15 will be a workhorse. Add with a starting storage of 128GB (twice the iPhone 12's base storage) and it's hard to complain about any of the specs.

Geekbench 5 (single-core)

iPhone 13 Pro: 1,740
iPhone 13: 1,728
iPhone 11 Pro Max: 1,601
iPhone 12 Pro Max: 1,334
iPhone XS Max: 1,114

Geekbench 5 (multi-core)

iPhone 13 Pro: 4,794
iPhone 13: 4,525
iPhone 11 Pro Max: 4,089

iPhone 12 Pro Max: 3,463
iPhone XS Max: 2,774

Geekbench 5 (Compute)

iPhone 13 Pro: 14,487
iPhone 13: 10,764
iPhone 11 Pro Max: 9,542
iPhone 12 Pro Max: 6,370
iPhone XS Max: 4,521

3DMark Wild Life

iPhone 13 Pro: 9,734
iPhone 13: 9,122
iPhone 11 Pro Max: 7,971
iPhone 12 Pro Max: 7,259
iPhone XS Max: 5,734

3DMark Wild Life Unlimited

iPhone 13 Pro: 11,681
iPhone 13: 9,848
iPhone 11 Pro Max: 8,535
iPhone 12 Pro Max: 7,958
iPhone XS Max: 6,111

3DMark Wild Life Extreme

iPhone 13 Pro: 3,042
iPhone 13: 2,503
iPhone 11 Pro Max: 2,271
iPhone 12 Pro Max: 2,055
iPhone XS Max: 1,437

3DMark Wild Life Extreme Unlimited

iPhone 13 Pro: 2,713
iPhone 13: 2,401
iPhone 11 Pro Max: 2,039
iPhone 12 Pro Max: 1,833
iPhone XS Max: 1,104

Battery life is even more impressive. On paper, Apple says the iPhone 13 will get two more hours of video playback and four more hours of streaming video, but those numbers don't really tell the whole story. In benchmarks, the iPhone 13 lasted nearly eight and a half hours, which is a good deal longer than the iPhone 12 Pro and nearly as long as the iPhone 12 Pro Max. That's kind of mind-blowing and easily the biggest generational leap in battery life. The Pro models still last longer, but it's not a stretch to say it's the most important upgrade in the iPhone 13.

Battery life wasn't exactly an issue with the iPhone 12, but with enough use, you probably needed to reach for a charger toward the end of the day. That's not even a passing thought with the iPhone 13. On one day of particularly heavy use, I spent significant time using Apple Maps and Apple Music, took lots of photos, played some games, and did all of the other usual things I do while leaving the brightness higher than usual (it was a particularly sunny

day), and I barely hit the red when I was ready to go to bed. And when I forgot to charge it, I still had enough juice to get through my morning before a quick charge.

Battery life

iPhone 13 Pro: 555
iPhone 13: 491
iPhone 11 Pro Max: 412
iPhone 12 Pro Max: 362
iPhone XS Max: 264

It's safe to say battery life won't be a concern with the iPhone 13. Like the processor, Apple has delivered more than we actually need, and with the rare exception of travelling overnight without a charger, iPhone 13 users won't need to pay much attention to the battery icon anymore (though I still wish Apple would bring the percentage back).

Incremental camera upgrades

Along with the battery, the camera is the biggest improvement over the iPhone 12. Apple is using the same basic hardware – dual 12Mp wide and ultra-wide cameras with 2x optical zoom out – but the technical aspects have changed. The sensor in the wide camera is larger, the sensor in the ultra-wide camera is faster, and the system now has sensor-shift stabilization rather than the previous lens-based stabilization.

While you will take better pictures with the iPhone 13, however, they won't be terribly noticeable when coming from the iPhone 12. That's

When comparing things like colour and white balance, the iPhone 13 (left) is virtually indistinguishable from the iPhone 12 (right).

The iPhone 13 (left) does take better low-light photos, but you'll need to compare it side by side to the iPhone 12 (right) to really see it.

not meant as a criticism, the iPhone 12 took fantastic photos as well. If you're upgrading from an iPhone 12 for the camera, I'd recommend either getting an iPhone 13 Pro or waiting for the iPhone 14.

But if you're coming from an older phone, particularly an iPhone XR or earlier, the difference will be significant. The iPhone 13 takes fantastic photos in all kinds of light, but it truly excels in low-light situations. Apple introduced Night mode on the iPhone 11 and it's gotten better with each new phone. The best improvement this year – other than improved image processing – is the bigger 1.7µm pixels on the Wide camera, which captures 47 per cent more light, according to Apple.

That may be true, but it's still very hard to see the difference between the iPhone 13 and iPhone 12 when it comes to night-time shots. When you compare the two photos side by side you see a bit more detail and some more sharpness with the iPhone 13, but for the most part, both phones will produce very similar and very good photos in low light.

The same goes for photos taken in better light. Even without a telephoto lens, the iPhone 13 takes fantastic photos with just a tap. The new Photographic Styles feature is impressive for its subtlety and adherence to the scene, but not likely

to be something people use all that often. The same goes for Cinematic Mode video, which is very cool and impressive but only useful in very specific situations.

At 3x zoom, the iPhone 13 Pro (right) takes far superior pictures than the iPhone 13 (left).

I've been using both the iPhone 13 and iPhone 13 Pro Max, and this is the first year I'd recommend spending a little more on the Pro to get a better camera. No longer are the differences geared only toward super high-end photographs. The main feature I missed from the iPhone 13 Pro is macro mode. While there's already a software solution from Halide that mimics it fairly well, it's not as smooth and automatic as it is on the iPhone 13 Pro, nor can you get nearly as close to your subject. And when you get up

When shooting up close in macro mode, the iPhone 13 (left) can't hold a candle to the iPhone 13 Pro (right).

close to take a photo with the iPhone 13's stock camera app, pictures are a blurry mess.

We outlined the advantages of the iPhone 13 Pro camera in our extensive review, and it brings an array of hardware and software enhancements that you won't get on the iPhone 13. The iPhone 13 has a great camera for sure, but it doesn't feel like a generational leap like the Pro model does.

Verdict

The iPhone 13 is an easy phone to recommend. Even with iPhone 12 looks, it doesn't feel like a stale design and it has tremendous battery life. At £779, it's the same price as the iPhone 12 and you get a little more for your money in 2021. There's no doubt that the iPhone 13 will be a fantastic upgrade for anyone using an iPhone 11, XR, or XS. And getting 128GB of storage instead of 64GB is nice, too.

But if you already have an iPhone 12 and want one of the newer phones, the iPhone 13 Pro is a better option. Yes, it's £170 more expensive, but you're getting a lot more for the extra £170: a better display (brighter and with ProMotion), processor (five GPU cores versus four GPU cores), camera system (telephoto plus wide and ultra-wide improvements), and longer battery life.

It's not that you won't be happy with the iPhone 13, but you'll be happier with the iPhone 13 Pro.

Michael Simon

Specifications

- 6.1in (2,532x1,170; 460ppi) Super Retina XDR OLED display
- iOS 15
- Apple A15 Bionic (5nm) processor
- Hexa-core (2x 3.22GHz Avalanche, 4x Blizzard) CPU
- Apple GPU (4-core graphics)
- 4GB RAM
- 128GB/256GB/512GB storage
- Dual rear-facing cameras: 12Mp, f/1.6, 26mm (wide), 1.7µm, dual pixel PDAF, sensor-shift OIS; 12Mp, f/2.4, 120-degree, 13mm (ultra-wide)
- Dual selfie cameras: 12Mp, f/2.2, 23mm (wide), 1/3.6in; SL 3D, (depth/biometrics sensor)
- Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS, GALILEO, BDS, QZSS
- NFC
- Lightning, USB 2.0
- Face ID
- Non-removable 3,240mAh

lithium-ion battery
- Fast charging 20 watts
- 146.7x71.5x7.7mm
- 174g

BEST IF YOU WANT BIG: iPHONE 13 PRO MAX

Price: £1,049 from fave.co/3mp8phJ

Last year, the iPhone 12 Pro Max was more than just a larger version of the iPhone 12 Pro. Apple gave it a slightly different camera system, which meant if you wanted the best iPhone you also had to get the biggest iPhone.

The iPhone 13 Pro Max is Apple's biggest phone.

With the iPhone 13 Pro Max, things are back the way they should be. This phone is identical in features and performance to the iPhone 13 Pro; it's just bigger. Bigger means heavier (naturally) and gives Apple room for an even larger battery. That larger battery, together with the other power efficiency improvements in the iPhone 13 Pro, make the Max the new battery life champ. It lasts much longer than the already-impressive iPhone 12 Pro Max.

As the iPhone 13 Pro Max is identical to the iPhone 13 Pro, you should check out our iPhone 13 Pro review (*iPad & iPhone User 173*) for the details about performance, the new ProMotion display, the new camera system, and more. This short review will cover only what is different: the size and battery life.

It's a Max all right

The iPhone 13 Pro Max is a big phone. It's the same size as the iPhone 12 Pro, with an identical size 6.7in display. That means 6.3 inches tall and just over 3 inches wide. Like the iPhone 13 Pro, the Max variant adds just a tiny bit of thickness and weight, but most of the heft comes from the fact that these phones have stainless

steel frames. At 240g, it's one of the heaviest premium phones at this size.

By comparison, Samsung's Galaxy S21+ also has a 6.7in display and weighs less at 200g. The iPhone 13 Pro Max is absolutely a two-hand phone. If you're unsure of the size, we recommend going to a store to try it, because it's an investment. Many people will love it but just as many will find it too big to carry and too awkward to hold.

Outside of its size, it's got everything you find in the iPhone 13 Pro. The same A15 processor (the version with a fifth graphics core), the same improved OLED display with up to 1,000 nits of brightness and 120Hz ProMotion variable refresh rate, the same excellent new camera system with a bigger wide camera sensor, better 3x optical zoom, and vastly improved ultra-wide with fantastic macro capabilities.

In our CPU benchmarks, you can see results are all essentially the same as the iPhone 13 Pro, within a typical margin of error.

Geekbench 5 (single-core)

iPhone 13 Pro Max: 1,752
iPhone 13 Pro: 1,740
iPhone 13: 1,728
iPhone 12 Pro Max: 1,601
iPhone 11 Pro Max: 1,334
iPhone XS Max: 1,114

Geekbench 5 (multi-core)

iPhone 13 Pro Max: 4,940
iPhone 13 Pro: 4,794
iPhone 13: 4,525
iPhone 12 Pro Max: 4,089
iPhone 11 Pro Max: 3,463
iPhone XS Max: 2,774

Geekbench 5 (Compute)

iPhone 13 Pro Max: 14,379
iPhone 13 Pro: 14,487
iPhone 13: 10,764
iPhone 12 Pro Max: 9,542
iPhone 11 Pro Max: 6,370
iPhone XS Max: 4,521

Moving over to graphics benchmarks, once again the iPhone 13 Pro Max is essentially the same as the iPhone 13 Pro. The fifth GPU core gives these phones a real advantage over the iPhone 13, which has a four-core GPU in its version of the A15.

3DMark Wild Life

iPhone 13 Pro Max: 9,743
iPhone 13 Pro: 9,734
iPhone 13: 9,122
iPhone 12 Pro Max: 7,713
iPhone 11 Pro Max: 7,423
iPhone XS Max: 5,739

3DMark Wild Life Unlimited

iPhone 13 Pro Max: 11,639
iPhone 13 Pro: 11,681
iPhone 13: 9,848
iPhone 12 Pro Max: 9,043
iPhone 11 Pro Max: 7,946
iPhone XS Max: 6,075

3DMark Wild Life Extreme

iPhone 13 Pro Max: 2,913
iPhone 13 Pro: 3,042
iPhone 13: 2,503
iPhone 12 Pro Max: 2,310
iPhone 11 Pro Max: 2,068
iPhone XS Max: 1,473

3DMark Wild Life Extreme Unlimited

iPhone 13 Pro Max: 2,795
iPhone 13 Pro: 2,713
iPhone 13: 2,401
iPhone 12 Pro Max: 2,029
iPhone 11 Pro Max: 1,860
iPhone XS Max: 1,115

With everything so similar to the iPhone 13 Pro, you'll want to read that review for more details about things like camera features and quality. But we'll give you a photo of the iPhone 13 Pro Max's macro mode, which is stunning (see opposite). Compared to the iPhone 13, the 13 Pro Max captures incredible detail at close range. By comparison, the iPhone 13's photo looks blurry and muddy.

The battery life champion

Apple put bigger batteries in the iPhone 13 line – the battery in the 13 Pro Max has about 18 per cent higher capacity than the iPhone 12 Pro Max. Combined with the more energy-efficient OLED display, more efficient wireless radios, and the ability of the ProMotion display to turn the refresh rate down, you get some really fantastic battery life. We run our battery benchmark at a constant 200 nits brightness, with no True Tone or adaptive brightness. Then we run the Geekbench 4 battery test, which puts a significant strain on the entire processor, CPU, and GPU. We record how long the battery lasts (in minutes) from a full charge until the phone dies. It's a reasonable representation of how much screen-on time you can expect in mixed-use.

The results are impressive, to say the least. The iPhone 13 Pro Max ran for 11 hours 41 minutes, three hours longer than the iPhone 12 Pro's time (and that was already quite good).

Battery life

iPhone 13 Pro Max: 701
iPhone 13 Pro: 555

These raspberries look nearly perfect using the iPhone 13 Pro Max's macro mode.

iPhone 13: 491
iPhone 12 Pro Max: 521
iPhone 11 Pro Max: 427
iPhone XS Max: 314

The iPhone 13 Pro Max lasts a whopping 34 per cent longer than the iPhone 12 Pro Max, and 26 per cent longer than the iPhone 13 Pro. It's really incredible how much Apple has done to improve battery life in recent years. Consider that the iPhone XS Max is only three years old, and Apple has more than doubled battery life while dramatically improving both performance and display quality.

This is what you buy the iPhone 13 Pro Max for. It costs £100 more than the iPhone 13 Pro, already a very expensive phone. But if you want a big huge display and a big huge battery, it's well worth the premium.

Michael Simon & Jason Cross

Specifications

- 6.7in (2,778x1,284; 458ppi) Super Retina XDR OLED display
- iOS 15
- Apple A15 Bionic (5nm) processor
- Hexa-core (2x 3.22GHz Avalanche, 4x Blizzard) CPU
- Apple GPU (5-core graphics)
- 6GB RAM
- 128GB/256GB/512GB/1TB storage
- Four rear-facing cameras: 12Mp, f/1.5, 26mm (wide), 1.9µm, dual pixel PDAF, sensor-shift OIS; 12Mp, f/2.8, 77mm (telephoto), PDAF, OIS, 3x optical zoom; 12Mp, f/1.8, 13mm, 120-degree (ultra-wide), PDAF; TOF 3D LiDAR scanner (depth)
- Dual selfie cameras: 12Mp, f/2.2, 23mm (wide), 1/3.6in; SL 3D, (depth/biometrics sensor)
- Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
- Bluetooth 5.0, A2DP, LE

- GPS with A-GPS, GLONASS, GALILEO, BDS, QZSS
- NFC
- Lightning, USB 2.0
- Face ID
- Non-removable 4,352mAh lithium-ion battery
- Fast charging 15 watts
- 160.8x78.1x7.7mm
- 240g

BEST IF YOU DON'T MIND 2020'S FEATURES: iPHONE 12

Price: £679 from fave.co/3yn2fmZ

There used to be a theory that you should always order the second-cheapest wine on the menu, on the basis that it offers the best balance of value for money and not tasting awful. In 2020, the second-cheapest wine on Apple's menu was the iPhone 12, but is it vintage or has it corked? We evaluate the device's camera performance, run speed, graphics and battery tests, discuss its new-look design and help you decide if this is right for you.

The iPhone 12 is perfect if you don't need the latest features.

Design

Since 2014, every iPhone except one (the original SE) has followed largely the same curvaceous design. But those days are over. The iPhone 12 is simultaneously groundbreaking and old-fashioned. Its square-edged design is strongly reminiscent of the iPhone 4, yet it combines this retro-feeling angular chassis with a modern all-screen layout, its 6.1in OLED screen absolutely dwarfing anything from that long-ago era.

This blend of old and new is a likeable combination, and a much-needed freshening-up for a design language that was

starting to feel slightly stale. But while it looks nice, there are some potential worries about the practicalities.

One is that sharply edged shapes are more susceptible to damage than curved ones, because the edges themselves will always take the brunt; the curve spreads the force across a wider area. Sure enough, shortly after the phones went on sale, one tweeter posted photos from a Chinese Apple Store that appeared to show the colour finish flaking from the frame of the handsets, particularly around the edge, after presumably vigorous handling by customers.

The curved design slips naturally into the hand.

I wouldn't worry about this too much, not least because of my long experience with Apple's high standards of quality control and thoughtful approach to design (with a few, ahem, exceptions), and haven't noticed any such issues with my iPhone 12 and 12 Pro review samples. But I'd still recommend either putting the phone in a case, or refraining from dropping it, or preferably both.

Another often ignored aspect of curved designs is how naturally they slip into a hand. While I'm bemused by the (again, isolated) reports that people have somehow managed to cut themselves, it's fair to say that it's not quite as comfortable to hold as an iPhone 11. Conversely, the edges make it less likely to slip out of the hand too, so drops should be rarer.

Display

To continue the theme of drop damage, the 12's screen has a new form of protection that Apple calls Ceramic Shield. The firm claims the use of nanoscale crystals in the glass improves drop protection by a factor

of four; I'm never comfortable with that sort of scientific jargon, but it suggests good intentions if nothing else.

I didn't want to test this too thoroughly – aside from not wanting to smash the screen of my borrowed sample, I was conscious that breaking or not breaking a single unit would not constitute a statistically valid test. But other testers have had no such qualms, and they conclude that the claims stand up: EverythingApplePro, for example, dropped an iPhone 12 and 12 Pro from head height on to a concrete floor, and neither showed any cracks.

Hopefully, then, your iPhone 12's screen will be able to withstand the rigours of everyday life. Which is good, because the screen itself is excellent: bright, sharp and vividly colourful.

It's a big step up from the iPhone 11. We've jumped from LCD to the greatly superior OLED tech (which gives deeper blacks, greater contrast and improved power-efficiency, although it can lead to burn-in if you're not careful) and from a resolution of 1,792x828, with a pixel density of 326 pixels per inch, to 2,532x1,170 and 460ppi.

It's a shame Apple wasn't able to squeeze in 120Hz ProMotion screens this year, with all of the 12-series models capped at 60Hz, but that probably would have been restricted to the Pro models anyway.

This big improvement in screen quality, which isn't apparent in the Pro line – since the 11 Pro already had OLED and a 400ppi+ pixel density – is one of the reasons why there's a sense that the 12 is this year's 'one To watch'.

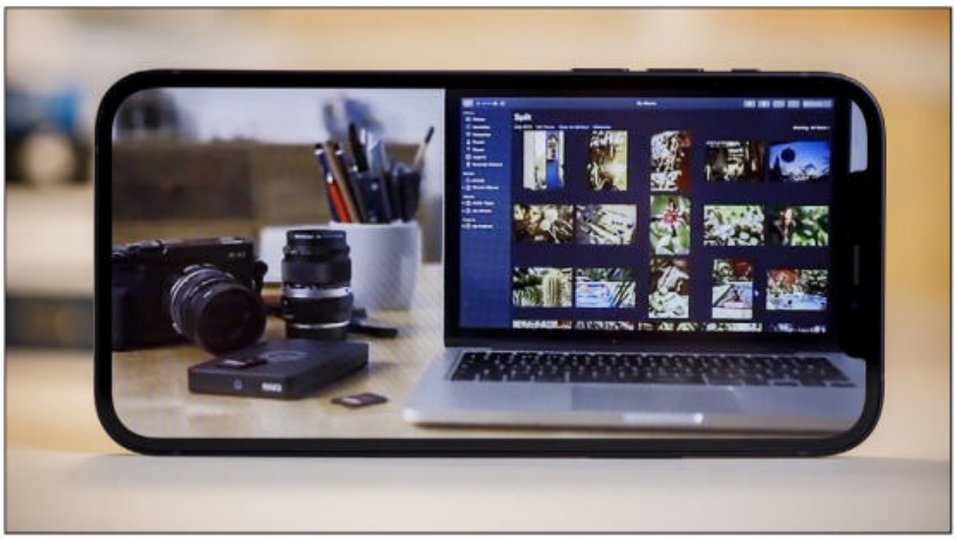
Photography

The most visible difference between the 12 and its costlier 12 Pro sibling

The iPhone 12 has two lenses on the rear, plus the new LiDAR scanner.

is the number of camera lenses on the rear. The 12 Pro has three of them back there, plus the new LiDAR scanner; the 12 has just two.

Of the 12 Pro's three lenses, the 12 misses out on telephoto. (Both 12-series handsets get wide and ultra-wide lenses.) This means, among other things, a reduction in optical zoom capabilities.



The iPhone 12's camera performance in the majority of shooting conditions is impeccable.

The LiDAR scanner, meanwhile, is a slightly mysterious new component that may find its true calling when AR features – its speciality – are more widespread. But it also enables 12 Pro owners to combine Night and Portrait Modes, allows for faster autofocus in low light, and generally helps the phone to construct an accurate 3D model of the surrounding environment – something that should come in handy when assessing where objects end and begin when applying bokeh.

Much as I said in the iPhone 12 Pro review, the 12's camera performance in the majority of shooting conditions is impeccable. It offers excellent detail and colour reproduction, along with intuitive, user-friendly auto settings that help the non-expert to get good shots without especially knowing what they're doing.

But the same could be said of the iPhone 11, and of the XS before it: we have to seek out difficult shots in order to see the differences between 11 and 12, and between 12 and 12 Pro. If you just want to take easy snaps in pleasant light you're unlikely to get your money's worth, at least photographically speaking, from the 12-series handsets.

The most common of those difficult shots is when you have multiple lighting conditions in the same frame. When shooting a subject with the sun behind, for example, which on a less sophisticated camera

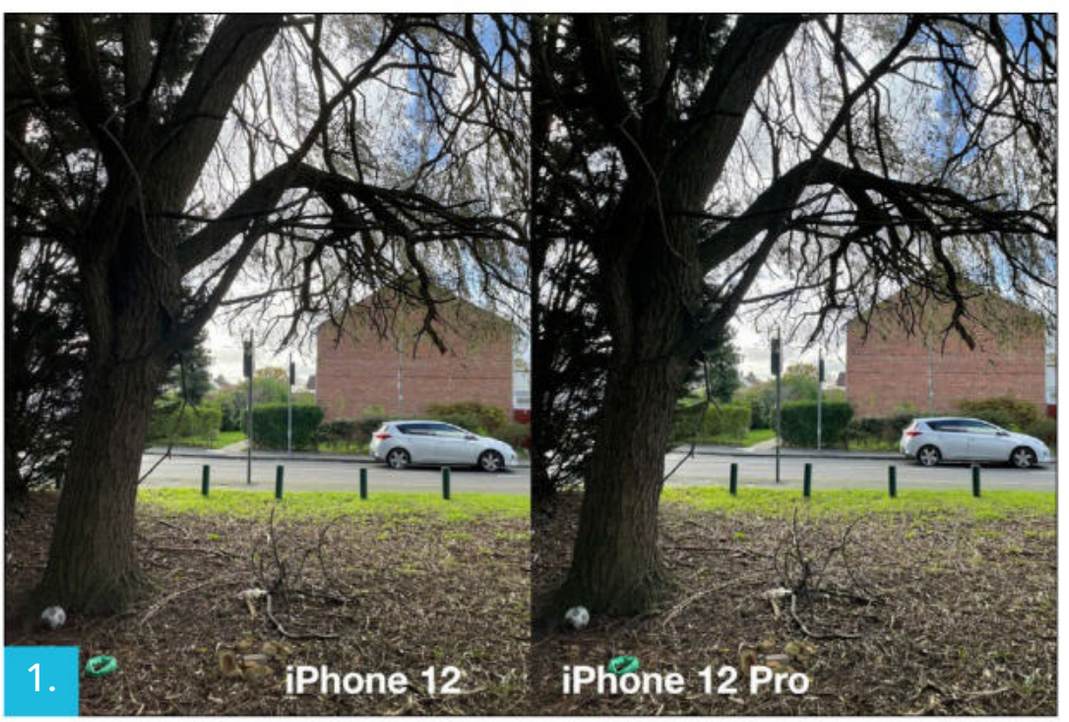
would result in either a lack of detail on the shaded subject or overexposure on the light source.

iPhones of recent vintage have Smart HDR, a feature that uses their processors' power to analyse multiple exposures and combine the best aspects for each area of the photo. On the 12-series handsets Smart HDR has reached version 3, which offers the finest analytical processes yet, and uses machine learning to deduce what a photo is of and apply the appropriate settings.

That's a lot of words to say that the iPhone 12 makes unwisely or recklessly composed photos look good. Here's a shot (**Image 1**) I took against diffuse but bright sunlight, and you'll notice that the colour and detail of the tree trunk is handled with great sensitivity without blowing up the exposure on the sky.

The 12 does a great job – although it's worth pointing out the greater contrast and depth the 12 Pro draws from the tree, making the 12's tree look flat by comparison. (You'll have to take my word for it on a lot of these comparisons. The difference is far more obvious when viewing the photos at full size on the phones' own screens.)

Let's take the lighting challenge a step further. Opposite is a shot of a child with the bright unclouded sun directly behind them (a handy option to have, incidentally, based on how hard children find it to pose for pictures with the sun in their face) – see **Image 2**. You'll see that both phones managed to achieve an admirable amount of detail on the face, although the 12's effort



is a touch darker, losing some of the sunniness. Still, a great effort.

Shooting against bright light is one of the challenges the 12 is designed to deal with; another is when there's almost no light at all. This is when Night Mode, which debuted last year on the 11-series iPhones, comes into its own.

Night Mode, which activates automatically, warning you with a small number in a yellow circle that it's going to extend the exposure for multiple seconds, is frankly miraculous in its ability to turn night into a sort of uncanny half-day. Elsewhere I've speculated about its honesty as a photographic form, given that the results rarely look anything

like the scene as viewed with a naked eye, and you're likely to see some shake during the longer exposure if you don't use a tripod or brace against a wall; but it's indisputably impressive from a technical point of view.

The next shots (see **Image 3**) were taken at roughly 10.30pm, and I don't remember it looking like this at all. The 12 Pro seems inclined to lighten the sky more than the 12, but in this case I feel that's the wrong decision; I prefer the 12's effort, very slightly.

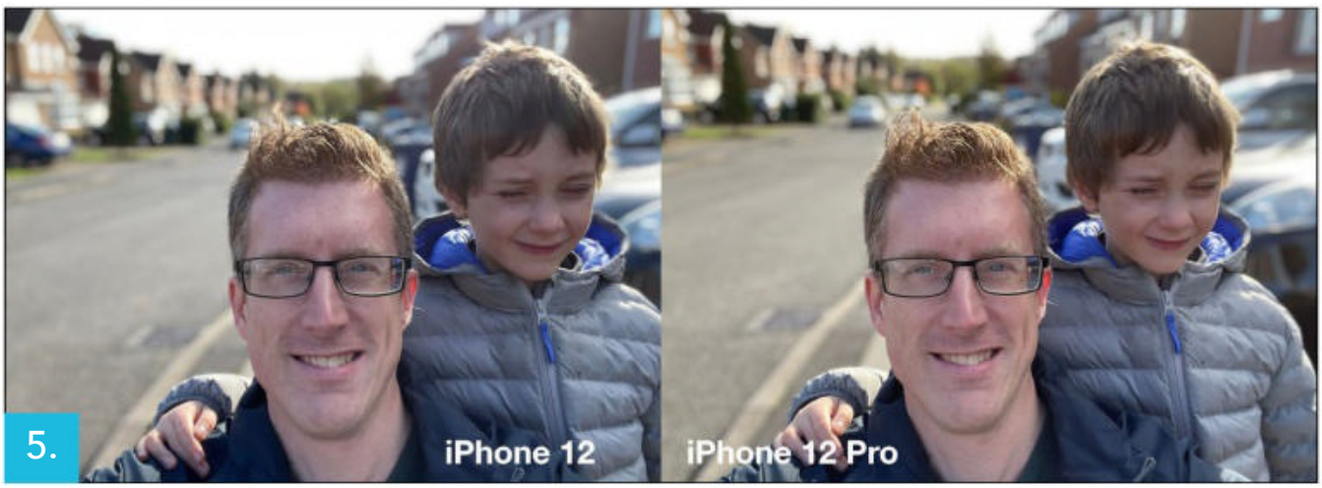
Night Mode on the 12 is slightly less versatile than on the 12 Pro, which this year gains the ability to combine it with Portrait Mode, even on selfies. I'm not sure that's a huge miss for 12 buyers; my experiences with the more expensive phone suggest that Night Mode Portraits are rather hit-and-miss, especially when using the front camera.

One final challenge I set for the iPhone 12's rear camera was a Portrait Mode shot with a busy background (**Image 4**). I wondered if the LiDAR scanner would make this job easier for the 12 Pro, but both models got confused about the same thing, misjudging the line around the subject's hand.

The 12's front-facing camera, meanwhile, is by all appearances specced identically to that of the iPhone 12 Pro – the only question is whether the 12's lower allocation of RAM could have any bearing at all on the processing capabilities of Smart HDR 3.

4.

Opposite is a Portrait Mode selfie (**Image 5**) that the 12 and 12 Pro both handled extremely well, with none of the malfunctions we saw around the edge of the previous test subject. Subjectively I



think the skin tones look nicer in the 12 Pro's shot, but the 12's colours are probably more realistic.

On the video side, my experience with the 12 was pleasing, achieving crisp, smooth footage with a minimum of effort and expertise. Just like last year's 11-series phones it can record 4K video at up to 60fps, but a new addition is the ability to capture 4K Dolby Vision HDR video up to 30fps. (The 12 Pro makes another effort here to justify its higher price tag by offering Dolby Vision up to 60fps.)

Dolby Vision is a relatively niche but technically sophisticated proprietary video format that the iPhone 12 also supports for playback; it uses metadata to tell a screen how best to show the video. The iPhone 12's presence on the market should ensure that Dolby Vision becomes far less niche over the coming months.

5G

The iPhone 12's flagship feature is support for 5G, but I've left it until now to discuss because it's likely to affect your day-to-day experience with the device less than the updated design, improved screen and Smart HDR 3 camera feature. There simply isn't the coverage yet for this to be a game-changing feature for most customers.

If you're giving this serious thought as a factor in the buying decision, it's worth doing your research. Look up your location on a coverage map – such as those provided by EE and O2 – and speak to your network about the practicalities. You will probably have to upgrade your contract, and may have to pay extra.

But a lack of current excitement doesn't mean it isn't important: this is about future-proofing (and, through Apple's market clout, making the

future happen sooner). When more of us can access 5G coverage it will be essential to own a 5G-ready phone. If you can get past the obstacles – aside from finding coverage and upgrading your contract, you'll have to live with higher battery drain – you can expect connection speeds in the region of 50 to 100 per cent higher than current 4G LTE.

That's not a small thing, and I don't want to minimize the effect of achieving something closer to Wi-Fi speeds away from home. But it's worth managing expectations about how much of a change you can expect right away.

Performance

The iPhone 12 gets the new A14 Bionic processor, the latest and fastest (and, thanks to the 5nm process, one of the most power-efficient) of Apple's proprietary chips. In this respect it exactly matches the 12 Pro, although the Pro accompanies the A14 with 6GB of RAM, to the 12's 4GB.

It would have been nice to have that extra RAM up your sleeve for the more demanding apps and tasks of the future, but for now you won't notice a difference between this and the Pro. In our speed benchmarks, in fact, the 12 matched the 12 Pro in single core and slightly outperformed it in multi-core – an unexpected victory.

The iPhone 12 was up around 19 per cent and 21 per cent on the 11 Pro in the two tests respectively.

Geekbench 5 (single-core)

iPhone 12: 1,594
iPhone 12 Pro: 1,595
iPhone 11 Pro: 1,335

Geekbench 5 (multi-core)

iPhone 12: 4,116
iPhone 12 Pro: 4,032
iPhone 11 Pro: 3,390

Benchmarks are all about establishing the limits of a device's theoretical speed, but you won't need anything like this power in your day-to-day phone use. Subjectively we didn't notice any difference, in fact, between performance on apps and games with the 11 Pro, 12 and 12 Pro: all three devices remain uniformly quick, slick and smooth.

Again, we have to use that phrase 'future-proofing': you're not paying for performance now, you're paying for performance in 2021 and 2022, when the apps will be more demanding.

A strong showing in the general-speed tests, then, but graphical benchmarking was less conclusive

about the gains from the previous generation. Our GFXBench Metal tests showed no improvement at all, in fact, although our US colleagues were able to detect small gains in 3DMark's Wild Life and the Ice Storm test.

The iPhone 12, like the 12 Pro, is compatible with Apple's new range of MagSafe charging accessories.

GFXBench Metal Car Chase

iPhone 12: 51fps
iPhone 12 Pro: 46fps
iPhone 11 Pro: 51fps

Geekbench 5 Manhattan

iPhone 12: 60fps
iPhone 12 Pro: 60fps
iPhone 11 Pro: 60fps

Geekbench 5 T-Rex

iPhone 12: 60fps
iPhone 12 Pro: 57fps
iPhone 11 Pro: 59fps

Battery life

Apple claims the iPhone 12 is good for 11 hours of streamed video playback, or 17 hours of non-streamed. That's the same estimate the company gives for last year's iPhone 11, despite battery capacity having dropped from 3,110mAh to 2,815mAh.

Lasting 6 hours and 36 minutes in the battery segment of the Geekbench 4 benchmark, the iPhone 12 performed pretty well for an iPhone – somewhere between the 5:33 of the iPhone 11 and the 7:22 of the 12 Pro – but is well behind the average for an Android handset. One Android phone, the Xiaomi Mi 10T Pro, lasted more than 14 hours in that test.

Bear in mind that the Geekbench test is designed to push phones to their limit, and real-world usage will be far less demanding. As ever with battery estimates, it's important to stress that Your Mileage May Vary, depending on whether you spend

most of your phone time browsing the web or playing graphically demanding games. But you ought to expect the iPhone 12 to comfortably last from wake-up to bedtime without having to be topped up.

In one busy day of testing, I took the 12 off its charger at 7.15am and used it for photography, speed benchmarking, music, web browsing and a variety of apps and games. By the time I went to bed at 11pm it was still on 18 per cent – pointing to a total projected span, based on that day's level of use, of something in the region of 19 hours. That's not outstanding, and of course battery life will worsen as the components age, but it's decent.

The iPhone 12, like the 12 Pro, is compatible with Apple's new range of MagSafe charging accessories (see page 42). I tested charging speed with the basic MagSafe charger and a 29-watt USB-C plug and it went from 0 to 21 per cent in 30 minutes: not exactly lightning-quick.

Verdict

The iPhone 12 is a compromise choice for those whose budgets don't stretch to the Pro models, and it can be hard to get excited about compromise. But you should try, because there's a huge amount to like here.

The biggest step forward is the screen, which brings the standard iPhone closer than ever to its Pro equivalent. OLED and the substantially higher resolution make this an elite display that's a pleasure to use.

The camera set-up is superb too, capturing colourful, detailed shots in some of the most difficult conditions I was able to find. You're missing out on the 12 Pro's superior optical zoom and more versatile Night Mode, but the photographic differences between the two devices are minor.

Like the Pro, this is a phone with one eye on the future, and those of us who buy an iPhone with the expectation that it will last us two years or more will appreciate its 5G readiness and the processing power that feels like overkill on today's apps. MagSafe compatibility, too, will become more valuable as the third-party accessories market grows.

The only fly in the ointment, really, is the relatively disappointing battery performance, but it suffers only by comparison with the market-leading Android phones. Battery life is solid, rather than dazzling, and it should get you through a day of typical use without any worries.

If money is no object, then of course you should buy one of the

This is a phone with a superb camera set-up.

Pro models and good luck to you. But money is very rarely no object, and considering how close the 12 comes to the 12 Pro in the key areas (design, speed, camera performance) while costing £200 less, we'd recommend this as the best choice for most iPhone buyers right now. This year it's all about the inbetweeners. **David Price**

Specifications

- 6.1in (2,532x1,170; 460ppi) Super Retina XDR OLED, HDR10 touchscreen
- iOS 14.1
- Apple A14 Bionic (5nm) processor
- Hexa-core (2x 3.1GHz Firestorm, 4x 1.8GHz Icestorm) CPU
- Apple (4-core graphics) GPU
- 4GB RAM
- 64GB/128GB/256GB storage
- Two rear-facing cameras: 12Mp, f/1.6, 26mm (wide), 1.4µm, dual pixel PDAF, OIS; 12Mp, f/2.4, 120-degree, 13mm (ultra-wide), 1/3.6in
- Dual selfie cameras: 12Mp, f/2.2, 23mm (wide), 1/3.6in; SL 3D, (depth/biometrics sensor)
- Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS, GALILEO, QZSS
- NFC

- Lightning, USB 2.0
- Face ID
- Non-removable 2,815mAh lithium-ion battery
- Fast charging 20 watts; 50 per cent in 30 minutes (advertised)
- 146.7x71.5x7.4mm
- 164g

BEST IF SMALL IS A BIG DEAL: iPHONE 13 MINI

Price: £679 from fave.co/3DRRFX4

Where to start with the iPhone nobody wanted?

After reportedly disappointing sales of the 12 mini – accounting for just 6 per cent of sales, these were so disappointing that Apple had to scale back production – many pundits, including this one, advised the company to shelve the small-handset project and stick to big phones.

But Apple decided to give it one more year. Come 2022, chances are iPhone buyers' choices will be large or really large, and perhaps we'll regret that we didn't appreciate these pocket rockets while they were around.

In our in-depth iPhone 13 mini review we test the device's speed, camera and battery performance, evaluate its design and ease of use, and generally help you decide if this phone – the last of a dying breed, it would appear – is the right one for you.

Design

The physical design has barely changed from last year, with the

You don't need a huge phone to get the latest features.

same squared-off edges and iPhone 4-style nostalgia aesthetic as on the 12-series handsets.

Apple habitually goes four or more years between chassis redesigns (the iPhone SE from 2020, in one of the company's more extreme examples of recycling, was based on a design from 2014), so this is hardly unusual, and it's not a bad thing in any case: the 13 mini is a great-looking and beautifully constructed device. I'm just warning 12 mini owners not to expect meaningful visual change.

The 13 mini is a great-looking and beautifully constructed device.

Of course, the device's USP within Apple's range is its size, and while this evidently doesn't float the boat of the average iPhone buyer, I love the convenience and portability of the 5.4in screen and 140g body. I've been using an iPhone 12 Pro for a year, and expected to find it difficult adapting to a smaller screen – but in fact, the opposite was the case. I found the screen perfectly usable for games and TV, and was mainly struck by how small the phone felt in my pocket. Several times I panicked and thought I'd left it behind somewhere, but no: it was there, I just couldn't feel it.

That 140g figure is slightly up on last year, incidentally, and the 13 mini is also a quarter of a millimetre thicker than the 12 mini; I can't possibly imagine you'll notice either change. A more significant change is the switch from a vertical to a diagonal alignment on the rear camera

lenses, which Apple hasn't justified in technical terms but I can only assume is designed to accommodate larger sensors within a camera module of comparable size. It may also be intended as a badge of honour: look at me, I've got the new phone.

Colour Choices

Note that Apple, as usual, has taken the opportunity of an iPhone launch to rejig the colour options.

The iPhone 12 mini was available in purple, green, blue, red, white and black. Apple has dropped the green and purple options for 2021 and added pink, but even the colours that have stuck around have been tweaked: (Product)Red is now substantially darker, blue is lighter, and black, rebranded as Midnight, has a touch more blue than last year.

(White has also been rebranded, as Starlight. It looks largely the same, with perhaps the merest hint of gold, but I've not taken a close look at a Starlight handset.)

Display

Like the 12 mini, the 13 mini features a 5.4in (2,340x1,080 at 476ppi) OLED screen with a notch – but there are some changes when you look closer. For one thing the notch is narrower than last year: not dramatically so, and Apple hasn't implemented any obvious changes in iOS's interface to take advantage of the extra space in the 'ears' (this may happen in iOS 16), but it's enough to make the general experience slightly more pleasant and the notch slightly less intrusive.

Apple has rejigged the colour options.

If you look closely, you'll see that the iPhone 13 mini's notch is narrower than the 12 mini's.

Apple has also ratcheted up the screen's maximum brightness in typical use, from 625 to 800 nits. (The maximum HDR brightness remains 1,200 nits.) I wasn't hugely conscious of this change, but then I never found it necessary or desirable to push up the brightness on the 12 mini. As before, this simply seems like a very bright, sharp, colourful and vivid display that does the job of pretending not to exist: it's supposed to be a transparent window into a digital world rather than a design element in itself, and almost universally achieves this.

Note there's no ProMotion: that's the screen tech in the 13 Pro and 13 Pro Max that adjusts the refresh rate depending on the requirements of whatever the phone is doing at a given time, in order to produce silky animation when necessary while preserving battery life on other tasks. You can read more about that in our iPhone 13 Pro review.

Photography

I took the 13 mini out for a series of real-world camera tests, comparing its performance with that of last year's 12 – which it should obviously surpass – and the iPhone 12 Pro, which it also beats, according to an impressive report from DXOMark.

We started with the now-traditional test of Smart HDR: shooting a subject with the sun directly behind them.

(This is generally a terrible idea that you should try to avoid, simply because of the complex lighting demands it places on your camera and the overexposed skies and underexposed subjects that will frequently be the result. But there will be occasions when you can't help it, and in any case the yearly improvements in phone cameras have become so small that we have to push the devices into ever more difficult scenarios in order to demonstrate them.)

Smart HDR camera test 1.

The theory behind Smart HDR – Smart HDR 3 on the iPhone 12 and 12 Pro, and the new Smart HDR 4 algorithm on the iPhone 13 mini – is that it captures multiple exposures and intelligently combines them to find the optimal settings for each section of the image. That way it can bring out the detail of your shadowy subject without overexposing the sunny sky.

The results were counter-intuitive, with my own personal preferences running in exactly the wrong order. All three did a decent job – you can easily make out detail on the subject's face and clothing, despite the challenge of the backlighting – but the 13 mini felt the weakest overall. Whereas the 12 and 12 Pro both brought out vivid colours from the scene, the blue sky and pink dress in particular, the 13 mini added a noticeable grey cast. Perhaps this was more realistic (I don't remember it being this gloomy, however); but it's certainly a less pleasing outcome artistically.

I will add that the 13 mini captured a bigger image than the others (4,032x3,024, rather than 2,048x1,536, so it's capable of deeper cropping before you lose clarity.

Bizarrely, the 12 handled skin tones best of the three. But this may have been the lucky result of changes in conditions between shots, so let's try another.

All three phones maintain an impressive level of detail on the near surface of the tree, which in reality

Smart HDR camera test 2.

was cast in shadow by the bright sun poking through the branches. The 12 mini appears to have caught the most detail, although it's also the most plagued by lens flare; it's very subjective, but I'd say I like the 13 mini's rendition best of the three, offering more definition than the 12 Pro with a less intrusive sun than either of the others.

One more test of Smart HDR versions 3 and 4 shows once again that the 12 and 12 Pro are perfectly capable of capturing detail despite

Smart HDR camera test 3.

Smart HDR camera test 4.

intrusive backlighting, and that the 13 mini's improvements are more about reducing the dazzle of the light source while maintaining foreground detail, rather than improving detail.

However, just to reiterate that the 13 mini's sensors are superior and produce larger images that are better able to stand up to extreme crops, above is a hard close-up of the leaf in the previous picture.

Note that the 13 mini doesn't get the new macro capabilities offered by the 13 Pro and 13 Pro Max, so don't expect to take world-beating close-ups of ants.

Portrait mode

The 13 mini offers Portrait Mode on both front and rear cameras, and I found its depth perception decent in testing. As you'd expect, it renders a more accurate bokeh effect with the twin rear lenses. Even with a bright sun behind the subject the 13 mini produced a clean and defined edge, and an artistically pleasing treatment of stray locks of hair: in focus, but with a softer edge.

Using the front camera for a Portrait selfie with two subjects the 13 mini struggled a little more with the fine details, although the overall effect was pleasing. When I zoomed in I noticed that this time stray hair was lost in the blurred background – an understandable failing given that in this context the effect is produced through software rather than glassware, but still mildly disappointing.

I'm a fan of Portrait Mode in general but it doesn't feel like it's

moved forward significantly since the 12 mini.

Low-light photography

Talking of features that were also offered by the previous model, let's talk about low-light photography. I took the 13 mini out at night to test out its rendition of Night Mode, the feature first rolled out on the 11-series iPhones which turns night into day and produces images that are technically incredible but (in my view) slightly artistically suspect.

Interestingly, the 13 mini seemed far more flash-prone than the models I've tested in previous years. Whenever I took a night-time photo it would activate the flash by default, even though that's rarely a good option – you'll illuminate the subject, but the background will be basically black.

Deactivating the flash manually I got Night Mode to kick in, and this performed solidly, with the night sky transformed from near black to a light grey and respectable detail visible in both fore- and background. But as before, and because of the long exposure, I found it very susceptible to shake. It's very important to brace the phone against a knee (or use a tripod, ideally) to get sharp results.

Video

I've left one of the most interesting camera upgrades to last. And that is Cinematic Mode, a rough analogue to Portrait Mode for video capture.

This mode is activated in the same way as Portrait Mode, with a dedicated slot in the Camera app's carousel of options. It works in real time as you shoot, detecting faces automatically and adjusting the focal length to them; but you can tap different areas of the frame and direct the focus elsewhere. (This is non-destructive, however, and you can edit the video later to focus on something else.)

I've seen reviewers describe this mode as a gimmick, and wonder when it's likely to be used: those making short films can have fun with it, of course, but how many of us do that? But my sense is that, like Portrait Mode, it may end up as the default that I use nearly all the time (when shooting people, at least). I like the effect, think it's executed well, and can't really see any downsides to using it since you can always remove it afterwards.

Performance

As is traditional, all four 13-series iPhones have the same processor:

the A15 Bionic, the latest and fastest mobile system on a chip to roll out of Apple's factories. That isn't to say that they will produce identical performance, however, since the 13 and 13 mini have 4GB of RAM, whereas the 13 Pro and 13 Pro Max have 6GB.

Still, the iPhone 13 mini is capable of outstanding processing performance, and produced elite numbers throughout our benchmarking. In Geekbench 5's CPU test it scored an exceptional 1725 (single-core) and 4,622 (multi-core), compared to 1594 and 4094 by the iPhone 12 mini. That's a year-on-year increase of 8.2 per cent and 12.9 per cent respectively.

Geekbench 5 (single-core)

iPhone 13 Pro: 1,740
iPhone 13 mini: 1,725
iPhone 12 Pro: 1,595
iPhone 12 mini: 1,594
iPhone 11 Pro: 1,335

Geekbench 5 (multi-core)

iPhone 13 Pro: 4,794
iPhone 13 mini: 4,622
iPhone 12 Pro: 4,032
iPhone 12 mini: 4,094
iPhone 11 Pro: 3,390
Sony Xperia 1 III: 3,658

As ever, we have to warn that this theoretical improvement will be far less noticeable in real-world use, for the simple reason that the 12 mini's A14 chip is comfortably fast enough to run anything on the App Store. I found the 13 mini slick and responsive throughout testing, but I feel exactly the same about my 12 and 12 Pro samples, and you'll probably be in the same position if you're still using an 11-series iPhone.

Rather, this is a question of future-proofing: the A15 and A14 are both very fast now, but the A15 will still be fast for roughly a year longer than the A14 as app developers gradually introduce more demanding elements to take advantage of the more powerful hardware.

Graphics

Another difference between the standard and Pro handsets this year is the number of GPU cores they're equipped with: the 13 and 13 mini have four, while the 13 Pro and 13 Pro Max have five, and the latter are the ones to go for if you want the absolute best possible graphics performance. But again, the 13 mini gives a great account of itself in testing.

In the most demanding Aztec Ruins (High) section of the GFXBench

Metal test, the 13 mini recorded an exceptional frame rate of 51.5fps (averaged across three runs), compared with an equivalent figure of just 42fps for the 12 mini. Its superiority was less obvious in other sections, but only because they weren't demanding enough to harness its power.

GFXBench Metal Manhattan 3.1

iPhone 13 Pro: 60fps
iPhone 13 mini: 60fps
iPhone 12 Pro: 60fps
iPhone 12 mini: 60fps
iPhone 11 Pro: 59fps
Sony Xperia 1 III: 60fps

GFXBench Metal Car Chase

iPhone 13 Pro: 59fps
iPhone 13 mini: 60fps
iPhone 12 Pro: 46fps
iPhone 12 mini: 52fps
iPhone 11 Pro: 51fps
Sony Xperia 1 III: 48fps

GFXBench Metal Aztec Ruins (Normal)

iPhone 13 Pro: 60fps
iPhone 13 mini: 60fps
iPhone 12 Pro: 58fps
iPhone 12 mini: 59fps
iPhone 11 Pro: 59fps
Sony Xperia 1 III: 56fps

GFXBench Metal Aztec Ruins (High)

iPhone 13 Pro: 57fps
iPhone 13 mini: 52fps
iPhone 12 Pro: 38fps
iPhone 12 mini: 42fps
iPhone 11 Pro: 40fps
Sony Xperia 1 III: 36fps

Note that the Sony in the above set is of course running the open rather than the Metal benchmark, although it gives us an approximate idea of comparative performance.

Battery life

One of our reservations about the iPhone 12 mini – and indeed about the SE (2020), being seemingly a weakness inherent to small-form iPhones – was its relatively poor battery performance. That's not a total surprise, given that Apple is obliged to use a smaller battery in such devices, but was a worry nevertheless.

I'd love to be able to say that Apple has put such concerns to bed, but I don't think that would be completely true.

Sure, the company talks a good game. Battery performance was a major theme of the presentation, in which Apple said the new mini would last around an hour and a half longer

than its predecessor away from mains power; while the estimates on the specs page have jumped from 15 to 17 hours for video playback, from 10 to 13 hours for video streaming, and from 50 to 55 hours for audio.

(Aside from the yearly software optimizations that enable Apple to draw more performance from the same hardware, the 13 mini actually has a larger-capacity battery than the 12 mini, having jumped from 2,227mAh to 2,406mAh.)

But in real-world use, things didn't seem massively different.

Just like last year, the mini generally proposes Low Power Mode at some point in the evening (this happens automatically when it hits 20 per cent), and usually finishes the day somewhere between 10 per cent and 20 per cent. There was one anomalous day on which the phone made it to close of play on 25 per cent, which is great, but there was another when it scraped home with 4 per cent, which eagle-eyed readers of our 12 mini review will have spotted is even lower than the 7 per cent which was that device's worst day.

Looking on the positive side, it might be noted that the 13 mini never failed to make it through a full day on a single charge, and usually did so with reasonable ease: that, surely, is the main threshold of acceptability for a phone's battery performance. But I would retort that batteries degrade from the first day you use them, and because I was testing a brand-new sample this is the very best performance you can expect. A full day of use is indeed the minimum expected performance; but a year down the line you may not be able to depend upon it.

So much for subjective testing: what about the hard numbers? The 13 mini lasted 6 hours, 33 minutes in the Geekbench 4 battery test, compared to 8 hours, 11 minutes for the iPhone 13, 9 hours, 15 minutes for the 13 Pro and a whopping 11 hours, 41 minutes for the 13 Pro Max. It's very much the runt of the litter in this respect – but do please note that Geekbench is a demanding test designed to push phones to their limit, rather than a representation of typical usage.

Verdict

I doubt this is going to change anyone's mind.

I will repeat much of what I said last year: this is a super-powerful phone with a great screen and cameras in a convenient, highly portable chassis, and it has an awful

lot to recommend it. If you're in the overlap of the Venn diagram between 'wanting a small iPhone' and 'being prepared to pay top whack for it', this is a brilliant choice for you.

There's a lot to like about the iPhone 13 mini.

The problem is that very few people appear to be in that overlap zone, and one would imagine that most of those bought the iPhone 12 mini last year. And the improvements from the 12 mini are not significant enough to justify an upgrade: Cinematic Mode is appealing, but the other changes to the camera set-up are difficult to detect in any but the most artificially demanding conditions, while the additional processing power won't be felt until a year or two down the line.

My sense is that most potential 12 mini customers were put off by one (or more) of three factors: the screen was too small for their liking; the battery didn't last long enough; and the price was too high. The first and third have not changed, and while Apple talks a good game about the second one, it doesn't appear in testing to have changed a great deal.

So it's another 4.5-star review, and it gets my personal recommendation. But I can't see this phone turning around the fortunes of Apple's small-phone division (the next iPhone SE, being both small and relatively cheap, is the key release), nor can I see Apple releasing an iPhone 14 mini next year. Which is a shame, really, but understandable. **David Price**

Specifications

- 5.4in (2,340x1,080; 476ppi) Super Retina XDR OLED display
- iOS 15
- Apple A15 Bionic (5nm) processor
- Hexa-core (2x 3.22GHz Avalanche, 4x Blizzard) CPU

- Apple GPU (4-core graphics)
- 4GB RAM
- 128GB/256GB/512GB storage
- Dual rear-facing cameras: 12Mp, f/1.6, 26mm (wide), 1.7µm, dual pixel PDAF, sensor-shift OIS; 12Mp, f/2.4, 120-degree, 13mm (ultra-wide)
- Dual selfie cameras: 12Mp, f/2.2, 23mm (wide), 1/3.6in; SL 3D, (depth/biometrics sensor)
- Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS, GALILEO, BDS, QZSS
- NFC
- Lightning, USB 2.0
- Face ID
- Non-removable 2,438mAh lithium-ion battery
- Fast charging 18 watts
- 131.5x64.2x7.7mm
- 141g.

BEST WAY TO GET THE 2020 iPHONE FOR LESS: iPHONE 12 MINI

Price: £579 from fave.co/3pTDHxW

Size matters, and for the past four years Apple fans with small hands have been crying out for the company to make an iPhone they can hold comfortably. The SE (2016) was the last 4in iPhone – most likely last in the sense of 'final ever' – and nothing since has come close to that device's combination of portability and ease of use. But 2020 was the year of plenty, as far as iPhones go, and there's now something for everyone: like a 20th-century rugby union team, Apple's smartphone department welcomes all shapes and sizes. And the prop-forward iPhone 12 Pro Max had a scrum-half scurrying along behind it.

The 12 mini certainly isn't a 4in phone – its screen measures 5.4in, very nearly as large as that of the iPhone 8 Plus – but the chassis that screen is nestled in is the shortest, narrowest and lightest since the cherished SE (2016). To those of us who've been using mid-size iPhones for the past few years – in this reviewer's case, XS, 11 Pro, and most recently iPhone 12 and 12 Pro – this is a surprisingly petite package.

The question, of course, is what compromises have been made for the sake of miniaturization? Is battery life shorter, or screen usability weaker? In our iPhone 12 mini review, we're going to find out.

Design

We'd better start with the 12 mini's obvious quality, which is its small

The 12 mini is a brilliantly featured and specified phone.

size. If you're used to the Face ID phones Apple has been releasing in recent years the dimensions (131.5 x 64.2 x 7.44mm) and weight (133g) will feel almost strange in the hand, as if something is missing. But you'll quickly grow accustomed to the delightful convenience of a truly portable iPhone.

I'm not one of those who've demanded the return of the 4in iPhone, and don't consider my hands especially tiny. But I do think that smartphone owners in general, not just Apple fans, have been press-ganged into getting used to a size of device that isn't entirely user-friendly.

We find ourselves using them two-handed, or find that our thumbs can't reach the far corners of the screen, or that they won't fit in some pockets. Perhaps the screen space and battery capacity make this relentless expansion worth it, but when I think of the ease with which my iPhone 4 would slip into a pocket, and compare that to a current Max model, I wonder if the SE nostalgics might be right.

At risk of undermining my review – indeed the entire premise of reviewing – there's no substitute, when it comes to evaluating size, for holding a phone in your hand, and I'd suggest a visit to an Apple Store if you can manage it. (Creating a cardboard cut-out using the listed dimensions is a reasonable workaround.) But I might be able to give you an idea by saying that I can just hold the 12 mini's top and bottom corners with the thumb and forefinger of one hand. That's not something I've been able to do with an iPhone in a long time.

For a visual aid, here's the 12 mini with the considerably larger 12 Pro Max.

Moving away from size, we must address the angular design: the curved edges Apple has been turning out since 2014 are gone, and a squarer look, reminiscent of the iPhone 4, is back.

The square edges are one of those good news, bad news type deals. They look undeniably smart, and fresh after so many years of samey curvedness – presumably at some point Apple will switch back and we will all praise the fresh curved look – but they don't fit in the hand quite so ergonomically. A few early buyers have gone so far as to claim that 12-series handsets have cut them, and that seems a little far-fetched; but I might concede that it's a trifle less comfortable.

I do also worry about the robustness of such pronounced edges, which will take the full brunt if the 12 mini gets dropped, rather than spreading out the force like a curved object. Apple has been at pains to talk up the new phones'

The curved edges Apple has been turning out since 2014 are gone, and a squarer look, reminiscent of the iPhone 4, is back.

toughness, claiming for example that the Ceramic Shield screen feature makes that component four times more drop-resistant than the previous generation (a claim backed up by drop tests), and a colleague has cleverly observed that those sharp edges, while less palm-friendly, create a more secure grip and make drops less likely in the first place. But I'd still use a case.

This is a really high-quality display.

The last word on design goes to the updated range of colour finishes. In this respect the 12 and 12 mini are an interesting compromise between the garishness of the 11 and XR, and the sobriety of the Pro models.

You can get the 12 mini in white, black and (Product) Red, which is fairly standard, but there's also a stunning midnight blue and a delightful soft green. Neither of these yell "I am either 19 years old or 32 and trying a bit too hard" the way the XR's Coral did, for example, but they've got more vibrancy than the silver, gold and black offered with the 12 Pro. (To be fair, the 12 Pro also comes in blue, but it's a much darker and greyer blue.)

Display

If you're worried that a 5.4in screen isn't big enough for playing games on, don't worry, it's fine. If you're worried that it isn't big enough for watching TV, it's fine – not quite the same experience as a big-screen telly, of course, and less immersive than an 12 Pro Max, for sure. But it's fine.

You have to remember that screens like this used to feel big. When the iPhone 6 Plus came out, it was the biggest thing Apple fans had ever seen, and that was 5.5in. In a sane world this would still be regarded as a big phone screen.

What's more, this is a really high-quality screen. The 12 mini has a great resolution: 2,340x1,080 at 476 pixels per inch (ppi). And it's OLED. In previous years Apple has held back

OLED technology for its elite phones only – the X, the XS, the 11 Pro – while the XR and the 11 had to make do with LCD. But this year OLED has been opened up to all the new models.

There are pros and cons to OLED and LCD, but most of the pros are on OLED's side. It offers blacker blacks, more vibrant colours, greater contrast, improved energy efficiency and the ability to make the device thinner. All of this means that while the Pro screens largely offer more of the same this year, there's been a major leap from iPhone 11 (326ppi, LCD) to iPhone 12 and 12 mini (460ppi/476ppi, OLED).

In subjective terms, the 12 mini's screen is sharp and bright and colourful. It doesn't offer the 120Hz that was hoped for at one stage, but this is more of a disappointment for Pro buyers; it was never likely to reach this far down the range.

Photography

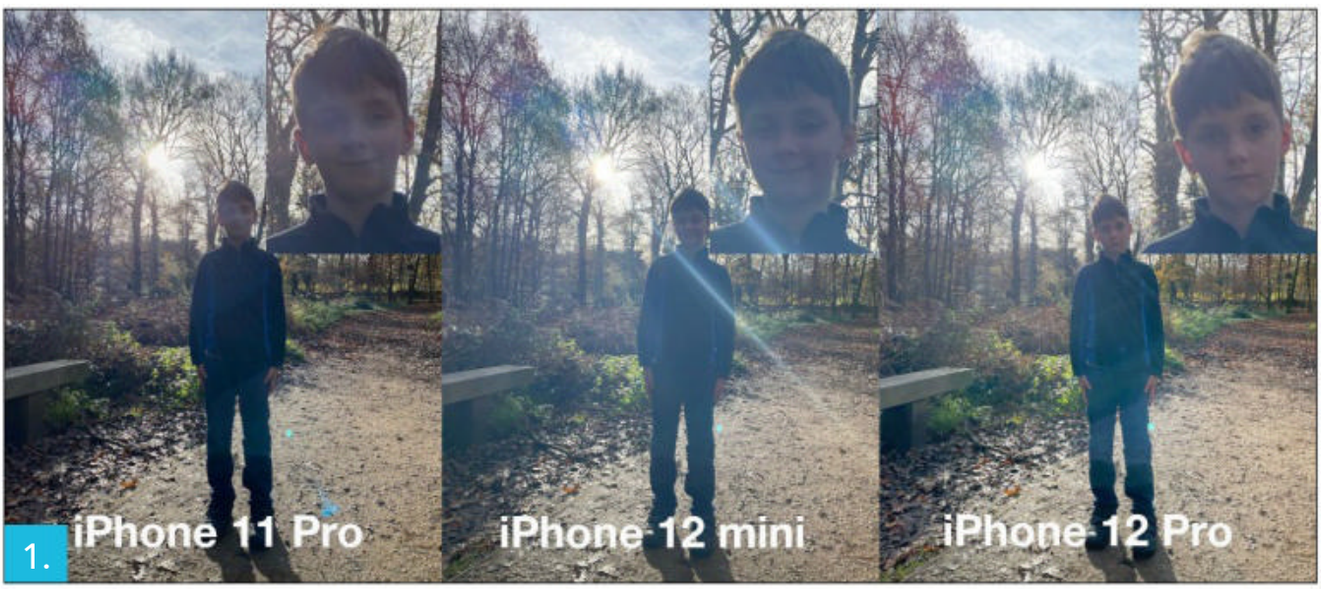
The 12-series iPhones have great cameras. The 12 and 12 mini are slightly less well equipped than the Pro models – for one thing they have only two lenses on the rear, rather than three lenses plus LiDAR – but the gap in performance between the two tiers has never been so narrow. Specs-wise we're talking dual 12Mp wide and ultra-wide lenses on the rear (f/1.6 and f/2.4 apertures), with a 2x optical zoom and 4K video recording up to 60fps. The front camera is also specified at 12Mp, with an aperture of f/2.2 and 4K video at 60fps.

But Apple tends to focus less on specs, and more on features. The central plank of Apple's iPhone photography strategy is currently Smart HDR, a feature that uses computational power to examine multiple exposures of a single shot and select the best outcome for each part of the photo.

In the 12 mini (as on the three other 12-series handsets) this feature has reached version 3, which Apple claims is capable of operating on a pixel-by-pixel basis.

The principle advantage of Smart HDR is the ability to handle mixed lighting conditions without underexposing the shaded areas or overexposing the bright spots. Take the opposite shot, which I took on the 11 Pro, the 12 mini and the 12 Pro (**1.**).

Two immediate observations. There's not much to choose between them (even though the 11 Pro is on Next Gen Smart HDR, while the others are on Smart HDR 3, and the 12 Pro has more RAM to apply to the image-



1.

processing task). And all three devices have done an excellent job with what is a challenging shot, which I arranged to have a low autumn sun directly behind the subject.

In the past such shots would end up with the subject as a silhouette, but here we have a respectably well-lit and detailed rendition of the subject's face. The 12 Pro, as you'd expect, does best, while the 12 mini's background is a touch misty – the Pro models both manage more contrast on the leaves and bench. But this is about as tough as daytime photography gets and I can't stress enough how impressive this is.

Let's try another (**2.**).

2.

There's no sign of the mistiness this time, which suggests to me that the mini just got a bit unlucky on the first test – sometimes a particularly fierce ray of light emerges from a cloud between test shots. It's also produced an excellent rendition of the right-hand log, which I'd even say I prefer to that of the 12 Pro.

That we can make out colour and contrast and detail on these pieces of wood stacked directly in front of the light source is highly impressive.

Selfie camera

Let's try the front-facing camera. Test selfies with the light source behind the subjects (to test out Smart HDR 3, which is on the selfie camera too) show good detail on faces and a vibrant, faithful rendition of colour (**3.**).

Now here's a Portrait Mode selfie, complicated by the inclusion of three subjects (**4.**).

It's not perfect: the A14 managed to grasp that the rogue arm in the middle belongs to (one of) the subjects, but has failed to blur out a section of grass below this, while some locks of hair have dropped into the bokeh effect rather than remaining in focus. But overall, considering that this is based on software rather than glassware, it's an excellent effort. The bokeh effect is strong and striking,

3.

4.

and you really have to zoom in to find any inaccuracies.

And leaving aside the qualities specific to Portrait Mode, take a look at the way the mini has captured the light and colour of that autumn morning. We've seen that it does an able job coping with difficult conditions; but in friendlier conditions, it simply takes lovely pictures.

Night Mode

This isn't a new feature – Night Mode was launched in 2019 – but it has been expanded. Unlike the iPhone 11, the 12 mini can use Night Mode for front-camera selfies and time-lapse videos. (The 12 Pro goes further still, offering Night Mode portraits, although we've found these rather hit-and-miss.)

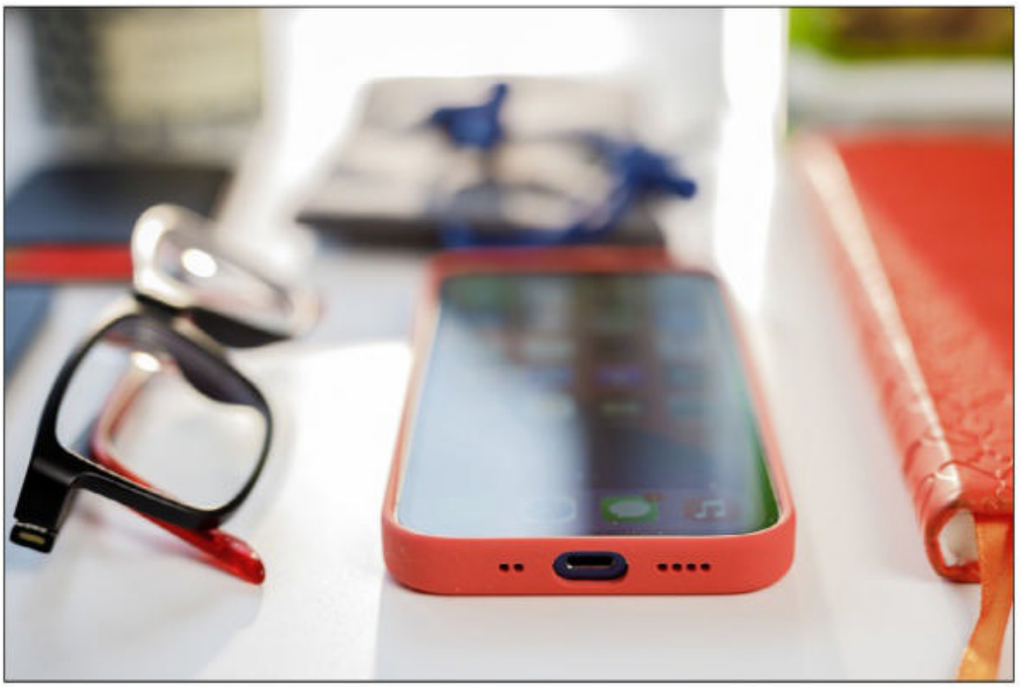
Before we get on to the new functions, let's remind ourselves of how effective Night Mode can be. The following shot was taken late at night, with the iPhone 8 showing what it looks like without Night Mode (**5.**).

I've written elsewhere about my qualms about this from an artistic point of view – that photo is not what it looked like through my eyes; it's an original creation, as far as I'm

5.

6.

concerned, rather than a documentary record – and the length of the exposure means camera shake can be an issue if you don't use a tripod or at least brace on a knee. But just look at the difference it makes to the grass, the sky and the houses in the background. It's astonishing.



Right now getting access to 5G is a tricky process that requires more than just a 5G-ready phone.

We've also an example of what Night Mode looks like on a selfie (**6.**).

I can't say I love the effect, which is rather unflattering, and the casual way selfies tend to be taken means camera shake/blur is more likely to be a problem than on rear-facing Night Mode shots. But again, look past the subject and check out the background: that's where you're really seeing the benefit.

Getting ready for 5G

Apple has pushed 5G as this year's breakthrough feature, but I'm going to warn right away that you'd be better off regarding it as something for next year instead. Right now getting access to 5G is a tricky process that requires more than just a 5G-ready phone – you'll need to upgrade the contract with your network provider, which may involve paying more, and be in a part of the country that's lucky enough to have good 5G provision. And using the new standard is likely to drain your battery faster. If you live in a major city, 5G might offer practical benefits right away: check a coverage map – such as those provided by EE and O2 – and speak to your provider about contract changes. But for many of us this is a question of future-proofing.

And it is absolutely true that anyone buying a new smartphone in late 2020 should really be looking for 5G support if they have any plans at all to keep it for multiple years. The tech will mean you can expect on-the-go connection speeds something like 50 to 100 per cent higher than current 4G LTE, and that's a big deal.

Performance

The iPhone 12 mini comes with the A14 Bionic processor, which is an absolutely state-of-the-art component. No Apple mobile device has a faster or newer chip – the 12 Pro Max gets an A14 too, and the 2020 iPad Pros are on the A12Z, which is based on a chip family that's two years older (albeit seriously souped up, as designated by that Z).

Where you might expect to see a difference in performance between the 12 mini and the 12 Pro is in the RAM allocation. Here's what the various 12-series handsets get, memory-wise:

iPhone 12 mini: 4GB
iPhone 12: 4GB
iPhone 12 Pro: 6GB
iPhone 12 Pro Max: 6GB

So it would be reasonable to expect the Pro models to pull ahead in tests where the extra memory is required. But that didn't really happen, at least in Geekbench 5. The 12 mini and 12 Pro were about evenly matched, and each showed an increase of around 19 per cent in single-core and 21 per cent in multi-core on the A13-equipped iPhone 11 Pro from last year.

Here are our benchmark results:

Geekbench 5 (multi-core)

iPhone 12 mini: 4,094
iPhone 12: 4,116
iPhone 12 Pro: 4,032
iPhone 11 Pro: 3,390

Geekbench 5 (single-core)

iPhone 12 mini: 1,594
iPhone 12: 1,594
iPhone 12 Pro: 1,595
iPhone 11 Pro: 1,335

Here, meanwhile, is how the mini got on in the GFXBench graphics tests. Again, we struggled to discern any improvement here on the previous generation, which is a disappointment. Our colleagues on Macworld US managed to spot some small increases from A13 to A14 in certain graphics tests (such as the 'unlimited' versions of 3DMark's Wild Life), but on the whole it would be best to regard this generation as a plateau, graphically.

GFXBench Manhattan 3.1

iPhone 12 mini: 60fps
iPhone 12: 60fps
iPhone 12 Pro: 60fps
iPhone 11 Pro: 59fps

GFXBench T-Rex

iPhone 12 mini: 60fps
iPhone 12: 60fps
iPhone 12 Pro: 57fps
iPhone 11 Pro: 59fps

GFXBench Car Chase

iPhone 12 mini: 52fps
iPhone 12: 51fps
iPhone 12 Pro: 46fps
iPhone 11 Pro: 51fps

Both sets of speed scores should be taken with the caveat that these tests are looking for theoretical power rather than real-world performance, and that in both general-processing and graphical terms the iPhone 12 mini is far more powerful than it currently needs to be. In general use it is fast, slick and smooth, and it is easily able to handle any app on the App Store right now.

In other words, like 5G, the mini's considerable processing muscle is best regarded as an exercise in preparing for the future. Switching from an iPhone XR to a 12 mini, for example, is unlikely to produce dramatic and immediate improvements in speed; but while the XR will fall off in performance in the medium term, the 12 mini is good for the more demanding apps that will be written for years to come.

Battery life

The 12 mini is rated by Apple as capable of up to 15 hours of video playback, or 10 hours if that video is streamed. That's lower than any of the other late-2020 phones, and only the SE is rated with less battery life:

iPhone 12 Pro Max: 20/12 hours
iPhone 12 Pro: 17/11 hours
iPhone 12: 17/11 hours
iPhone 12 mini: 15/10 hours
iPhone SE (2020): 13/8 hours
iPhone 11: 17/10 hours
iPhone XR: 16 hours/no estimate

This is to be expected. The bigger a phone, the more energy it needs to power its screen, but the bigger the battery it will be able to accommodate; and the sophistication of battery technology is such that the second one has more of an effect than the first. Big things last longer, as a general rule.

Our subjective experiences of the mini's staying power were okay. Not

The mini never failed to last a full day, but pretty much always proposed Low Power Mode at some point in the evening.

amazing, not horrible, just okay. In day-to-day usage power levels proved durable, but particularly demanding tasks really zapped it. A single run-through of GFXBench Metal would reliably knock off 15 per cent, and gaming sessions generally resulted in an alarming dip in power reserves.

The mini never failed to last a full day, but pretty much always proposed Low Power Mode at some point in the evening. Its lowest power reading at bedtime was 7 per cent, and that was after 15 hours of use; more commonly it would be somewhere between 10 and 20 per cent at lights out.

That's not a million miles away from the other 12-series handsets I've tested this autumn: the 12 ended a day of intense testing on 18 per cent, and the 12 Pro on 11 per cent. In all three cases I'd say battery performance is among the weaker suits, but not deal-breakingly bad. Lasting a day between charges is the bar you absolutely have to clear, and the 12-series phones all manage that – even if lots of Android handsets out there will last far longer.

MagSafe

Big batteries may offer longer life, but they also take longer to charge up... and here we hit one of the mini's controversies. Like all of the 12-series handsets – and no other iPhones – the 12 mini supports Apple's new MagSafe standard. This enables compatible charging accessories (such as Apple's own MagSafe Charger and MagSafe Duo Charger, but also a range of third-party offerings that should expand in future) to attach magnetically to the

sweet spot, and I really like it. You can read our review of the MagSafe Duo Charger on page 30.

You no longer have to worry about placing your phone on its charging pad in fractionally the wrong position and waking up with it totally drained of battery (which happened with my iPhone 11 Pro, sinisterly, the night before I started testing the 12 Pro). It also means you can continue to use your phone, reasonably conveniently, while it's charging wirelessly, and even attach non-charging accessories such as a wallet.

The only downside to MagSafe that I can see is that it means you can't take the phone off the charger one-handed, as some may habitually do bleary-eyed in the morning; lifting the phone from the puck is now a two-handed job. But that's not the controversy.

The controversy is that the 12 mini is slower at charging than all the other MagSafe phones. For some unspecified reason, the 12, 12 Pro and 12 Pro Max all support 15-watt charging through MagSafe, but the 12 mini is limited to 12 watts.

This has ruffled some feathers, but in practice it doesn't seem to make much difference. I put a drained 12 mini and a drained 12 Pro on the MagSafe charger for 30 minutes apiece and they reached 35 per cent and 18 per cent respectively. The 12 mini's battery is so much smaller that it fills up more quickly, even though the charge is coming in more slowly.

Verdict

Quietly, sitting at the cheapest end of the 2020 generation, the 12 mini is the most revolutionary of Apple's late-2020 phones. This is because it combines, at long last, the all-screen design of the post-iPhone 8 handsets with the petite chassis of the pre-6 ones. And the result is the best of both worlds, and the question "Why didn't they do this before?"

It's a brilliant design that achieves the feat of not just being exactly what I wanted, but what I didn't even realise I wanted: it reminds me of the convenience of small phones, a convenience that's somehow been forgotten in a world of phablets and 6.5in screens. And it does this while offering a far larger screen than those small phones every managed.

But size isn't the only weapon up the mini's sleeve. It's just a brilliantly featured and specced phone, with superb cameras, a secure and user-friendly operating system, and processing power to burn. When 5G becomes more widespread, the mini

will be ready to take advantage. It matches or almost matches the Pro models in every key area, at a far lower price.

The main downside is the mediocre battery life, and that's been a persistent complaint through my tests with the 12-series handsets. But it's not terrible, and it does pass the all-important hurdle of reliably lasting a day between charges. I don't think it's a deal-breaker, but if battery life is your top priority, look elsewhere. **David Price**

The iPhone 12 mini is the most revolutionary of Apple's late-2020 phones.

Specifications

- 5.4in (2,534x1,080; 476ppi) Super Retina XDR OLED, HDR10 touchscreen
- iOS 14.1 (upgradeable to 14.2)
- Apple A14 Bionic (5nm) processor
- Hexa-core (2x 3.1GHz Firestorm, 4x 1.8GHz Icestorm) CPU
- Apple (4-core graphics) GPU
- 4GB/6GB RAM
- 64GB/128GB/256GB storage
- Two rear-facing cameras: 12Mp, f/1.6, 26mm (wide), 1.4µm, dual pixel PDAF, OIS; 12Mp, f/2.4, 120-degree, 13mm (ultra-wide), 1/3.6in
- Dual selfie cameras: 12Mp, f/2.2, 23mm (wide), 1/3.6in; SL 3D, (depth/biometrics sensor)
- Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS, GALILEO, QZSS
- NFC
- Lightning, USB 2.0
- Face ID
- Non-removable 2,227mAh lithium-ion battery
- Fast charging 20 watts; 50 per cent in 30 minutes (advertised)
- 131.5x64.2x7.4mm
- 133g

BEST FOR VALUE: iPHONE 11

Price: £489 from fave.co/31U28TS

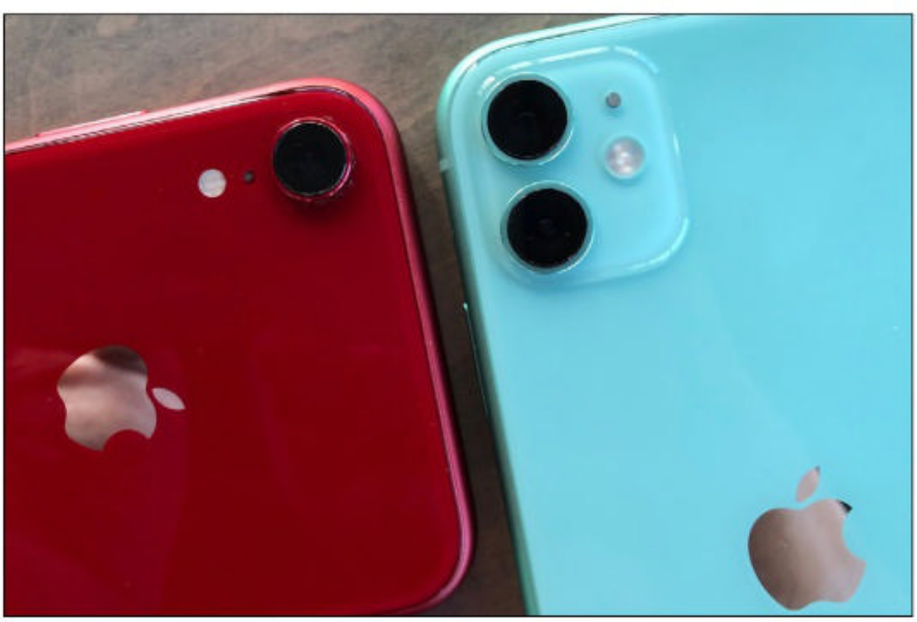
Apple introduced the iPhone XR as the 'affordable' offering in its iPhone line-up in 2018. We liked the XR a lot, and we even said that it might be the best iPhone Apple has ever made. The follow-up to the iPhone XR is the new iPhone 11, and the fact that Apple decided to bless this model with the 'iPhone 11' title – and not call it something like the iPhone 11R – says a lot about where the company positions the phone.

But can this phone carry the burden of being known as the iPhone 11? As a matter of fact, it can. The satisfying speed boost, dual camera set-up, and long battery life combine to make the iPhone 11 even better than last year's iPhone XR. And given its relatively low price tag, it's probably the best new iPhone for most people.

Camera improvements

The marquee feature of the iPhone 11 is its 12Mp dual camera set-up. It seems as though Apple decided that with this phone, it would make the camera bump deliberately eye-catching. The iPhone XR's single camera is barely noticeable, and the iPhone XS's dual camera bump design doesn't make you think twice about what it looks like. But the iPhone 11's dual camera demands your attention, screaming, "Smile! You're on camera!"

The iPhone 11 has a wide camera like the one on the iPhone XR, but the iPhone 11's second camera is an ultra wide camera that offers a 2x zoom out, allowing you to capture more of whatever environment you're shooting. These two cameras are also on the iPhone 11 Pro, which adds a third, telephoto camera to zoom in really close.



The iPhone XR (left) has a single wide camera. The iPhone 11 (right) has wide and ultra wide.

The ultra-wide is an excellent addition, giving you even more flexibility when shooting pictures. Fortunately, Apple makes it easy to switch between wide and ultra wide. When framing a shot in the Camera app, a 1x button appears at the bottom of the image frame, which means the wide camera is in use. Tap this button, and the phone switches to the ultra wide camera, and the 1x button becomes a 0.5x button. Tap the button again to switch back. Also, when you're in the 1x camera view, you'll get a preview for what a 0.5x ultra wide shot would look like.

Shot using the iPhone 11 1x wide camera.

While using the wide camera, you can see a preview of the ultra-wide view without having to switch to the ultra wide camera.

In terms of actual picture quality, both the wide and ultra wide produce great-looking photos. Colours are accurate, and the cameras deliver a stunning level of detail and image clarity. Of course, we've said the same thing about previous iPhones, and it's still true with the iPhone

The resulting image using the iPhone 11 ultra-wide camera.

11. But exclusive to the iPhone 11 (and 11 Pro) is a new Night mode that completely reinvents Apple's low-light photography game. Indeed, if you're looking for just one reason to buy a new iPhone, this is probably it. Night mode takes images shot in dark environments and uses software processing to reveal details that would otherwise be lost.

Low-light enhancement had been available in Android phones, and it was finally on the iPhone, and it works really well. Our sister publication, PCWorld, even found that Apple's Night mode is better than Android's version. Bottom line: it's a useful feature that produces great results.

The one issue I have with the iPhone 11's rear camera is the lack of optical zoom. As it was with the iPhone XR, the iPhone 11 has only digital zoom, up to 5x. In some instances, especially when you go past 2x digital zoom, you get noticeable image noise, making for an

There's no optical zoom with the iPhone 11 camera, though it does offer 5x digital zoom.

unsightly photo. So, if you're like me and you tend to use zoom a lot, you need to rethink how you use it on the iPhone 11.

It's worth mentioning that Apple finally upgraded the front-facing TrueDepth camera, from a 7Mp camera that shoots 1080p/60fps video to a 12-megapixel camera that shoots 4K/60fps video camera. And the front camera can record slow motion video, which wasn't previously available. So, yeah. Let's see if Apple can make 'slofies' happen.

Shot without using Night mode.

Shot with Night mode active.

Performance

At the heart of the iPhone 11 is a new A13 Bionic processor, the successor to the A12 Bionic that's in the iPhone XR. The A12 Bionic is an impressive chip, so what does the A13 Bionic do to follow it up? With CPU performance, the gains are modest. In Geekbench 5 benchmarks, the iPhone 11 saw a 14 per cent increase over the iPhone XR in single-core CPU performance, while multi-core CPU performance jumped 18 per cent.

Geekbench 5 (single-core)

iPhone XR: 1,110
iPhone XS: 1,107
iPhone 11: 1,288
iPhone 11 Pro: 1,333

Geekbench 5 (multi-core)

iPhone XR: 2,734
iPhone XS: 2,735
iPhone 11: 3,338
iPhone 11 Pro: 3,544

Geekbench 5 (compute)

iPhone XR: 4,463
iPhone XS: 4,436
iPhone 11: 6,273
iPhone 11 Pro: 6,291

In benchmarks that stress the iPhone's graphics performance, the iPhone 11 showed more impressive gains over the iPhone XR. In 3DMark's Sling Shot benchmark, the iPhone 11 was 29 per cent faster in both the Sling Shot Extreme and Sling Shot Extreme Unlimited tests. In the 3DMark's Ice Storm Unlimited benchmark, the iPhone 11 was 20 per cent faster.

3DMark Sling Shot Extreme

iPhone XR: 3,602
iPhone XS: 3,557
iPhone 11: 5,095
iPhone 11 Pro: 5,356

3DMark Sling Shot Extreme Unlimited

iPhone XR: 4,297
iPhone XS: 3,955
iPhone 11: 6,137
iPhone 11 Pro: 6,360

3DMark Ice Storm Unlimited

iPhone XR: 77,344
iPhone XS: 75,528
iPhone 11: 97,048
iPhone 11 Pro: 97,106

The numbers show a boost in performance, but does the iPhone 11 feel faster than the iPhone XR? It most certainly does. In daily use, the iPhone 11 feels snappier, apps feel like they launch faster, and graphics

performance in games is noticeably smoother. This is even true when comparing the performance to the iPhone XS, which uses the same processor as the iPhone XR.

The iPhone 11 has the same processor as the iPhone 11 Pro, and the benchmark results overall for those phones were in line with each other. So, basically, for a few hundred pounds less, you can get the same performance in the iPhone 11 as you do the Pros. If performance is your top consideration, this is a value proposition that's difficult to ignore.

Battery life

Apple says that the iPhone 11's 3,046 mAh battery lasts up to one hour longer than the iPhone XR's 2,942 mAh battery, and you can get up to 17 hours of video playback, 10 hours of streamed video, and 65 hours of audio playback. Notably, Apple no longer provides an estimate for what it called "Talk time (wireless)". For the iPhone XR it was 25 hours, and we can calculate that you could get up to 26 hours on the iPhone 11. According to an Apple representative, the longer battery life was achieved through a combination of a bigger battery, and software and hardware optimizations.

We used the Geekbench 4 Battery Life test to gauge battery life and to compare it to other iPhones. Our test results showed that the iPhone 11 and the iPhone XR have similar battery life. In fact, in our testing, the iPhone 11 lasted only a few seconds longer than the iPhone XR. Our Geekbench 4 Battery Life test runs processor-intensive tasks (with screen dimming turned off) until the battery is drained, so it's not representative of real-world usage. Nonetheless, it's an effective way to consistently test different phones.

Battery life

iPhone XR: 333 minutes
iPhone XS: 264 minutes
iPhone 11: 333 minutes
iPhone 11 Pro: 362 minutes

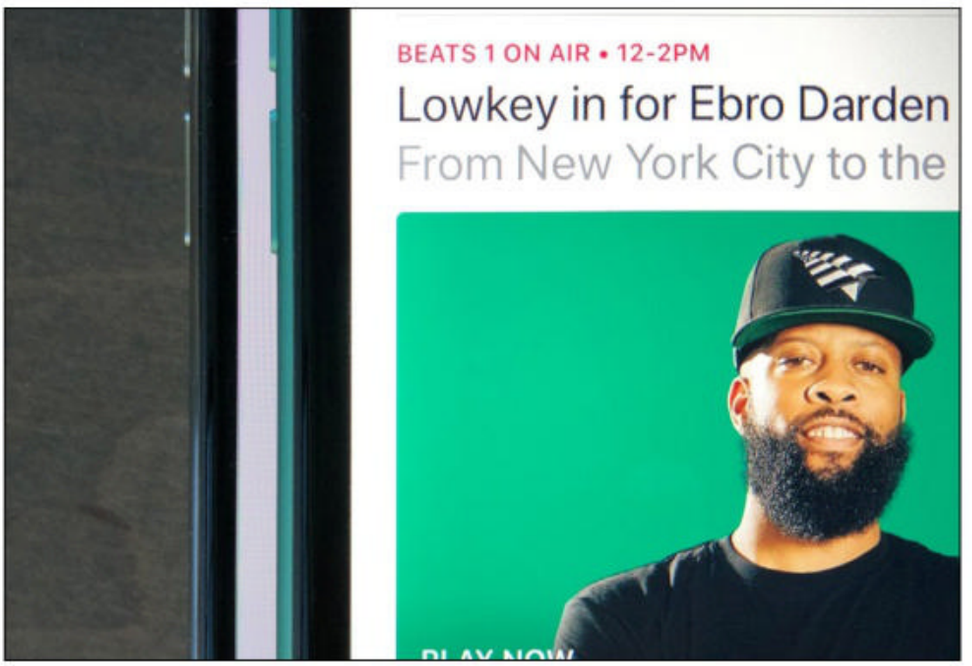
During daily use, I never had to charge the iPhone 11 before the end of my day. I think I'm a more demanding user than most, because I play Pokémon Go during my commute to and from work and on dog walks. On my most demanding day (a Saturday strolling through San Francisco's Golden Gate Park playing PoGo, watching my son's soccer match, and using Apple Maps navigation), I ended the day with 24 per cent battery left. Not bad at all.

The one major flaw in regards to the battery life is the included charger. Apple still includes a puny, slow 5-watt charger with its low-end model iPhone. For $29, you can buy Apple's 18W USB-C Power Adapter – the same one that's included with the iPhone 11 Pro. It's a bummer that Apple doesn't include this charger with the baseline model. The iPhone 11 also supports wireless charging, but you'll have to buy a Qi wireless charger separately.

Design

Apple didn't change much when it comes to industrial design. The iPhone 11 is very much like the iPhone XR, with anodized aluminium sides, the display notch, and a glass back available in black, green, purple, white, yellow and (Product)Red. That said, colour execution this year is different: Apple decided to go with pastel-like shades that are more subtle than the bright colours of the XR.

The iPhone 11 still sports black bezels that are thicker than those on the iPhones with OLEDs. And as long as this model continues to use an LCD (a lower-cost part than the OLED in the Pro model), the thicker bezels will persist to help stop light leakage. Mind you, I didn't find the bezels bothersome. In fact, I actually didn't notice them until they were pointed out to me.



The iPhone 11's bezel (right) is thicker than the bezel on the OLED phones, like the iPhone 11 Pro Max (left).

The most noticeable design change between the iPhone 11 and the iPhone XR (besides the colours and the camera bump) is the placement of the Apple logo, which is now centred instead of up near the camera. Rumour had it that one of the new features of the

On the iPhone 11 (right), Apple moved the logo to the centre of the phone. They also removed the 'iPhone' tag.

iPhone 11 was to be bilateral wireless charging, and the Apple logo would be centred to mark the spot where users should place their devices. But when the new iPhones were released, bilateral charging wasn't part of the feature list. One not-so-noticeable change is the iPhone 11's improved water resistance, which is now at 2m for up to 30 minutes, double the depth of the XR.

The iPhone XR's design worked well, so Apple was wise to stick to it on the iPhone 11. Best of all, the iPhone 11 doesn't feel like a cheaper version of the Pro models. It feels good and solid in the hand, and it's comfortable to use. Maybe the bezels will bother you, but you'd have to be pretty particular to find fault with them

Display

Another major feature that remains unchanged is the display. Apple is again using a 6.1-inch LCD, while the iPhone 11 Pro has an OLED. The iPhone 11 screen (Apple calls it a "Liquid Retina HD" display) is a Retina display with 326 ppi resolution, a 1,400 to 1 contrast ratio, and 625 nits of brightness. The iPhone 11 Pro's 'Super Retina XDR' display is rated at 458ppi, has a 2,000,000 to 1 contrast ratio, and offers 800 nits of brightness.

If you put the iPhone 11 and the 11 Pro next to each other, you can see differences if you look hard enough. The iPhone 11 Pro's screen is brighter, the colours have a little more pop, black looks deeper, and the detail is a tiny bit sharper.

But lacking any comparisons, the iPhone 11's screen looks great all on its own. The colour quality, brightness, and sharpness are much more than satisfactory. Yes, the OLED sets a high bar, and no, the LCD can't match it. But the LCD still looks great, and unless you simply demand the best, you won't find yourself pining for the Pro OLED.

The iPhone 11 uses the same good-looking LCD found in the iPhone XR.

Verdict

Apple had a winner with the iPhone XR, and while its follow up doesn't have to rewrite the book on mobile phones, it needs to do enough to be a worthy heir to the throne. The new iPhone 11 is up to the task, with compelling changes to the camera that will have even users of the year-old iPhone XR seriously consider upgrading.

To top it off, there's the iPhone 11 price. It starts at £489 for the 64GB model. Apple gets a lot of flak for its iPhone prices, so a price reduction of the company's most affordable iPhone is very much welcomed. It makes the iPhone 11 even more attractive, especially when you compare its price to that of the £779 64GB iPhone 13 or the top of the range £1,049 64GB iPhone 13 Pro Max. If you have an iPhone 8 or older and you've put off an upgrade, now is the time to pull the trigger. You'll enjoy great speed improvements and longer battery life. You'll also be able to have more fun with your photos with the dual camera set-up and Night mode. You'll need to get used to an iPhone without a Home button and the switch from Touch ID to Face ID, but give it a few days – the gestures and Face ID quickly become second nature. **Roman Loyola**

Specifications

- 6.1in (1,792x828; 326ppi) Liquid Retina IPS LCD touchscreen
- iOS 13 (upgradeable to 15.2)
- Apple A14 Bionic (5nm) processor

- Hexa-core (2x2.65 GHz Lightning, 4x 1.8GHz Thunder) CPU
- Apple (4-core graphics) GPU
- 4GB RAM
- 64GB/128GB/256GB storage
- Two rear-facing cameras: 12Mp, f/1.8, 26mm (wide), 1/2.55in, 1.4µm, dual pixel PDAF, OIS; 12Mp, f/2.4, 120-degree, 13mm (ultra-wide), 1/3.6in
- Dual selfie cameras: 12Mp, f/2.2, 23mm (wide), 1/3.6in; SL 3D, (depth/ biometrics sensor)
- Wi-Fi 802.11 a/b/g/n/ac/6, dual-band, hotspot
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS, GALILEO, QZSS
- NFC
- Lightning, USB 2.0
- Face ID
- Non-removable 3,110mAh lithium-ion battery
- Fast charging 18 watts; 50 per cent in 30 minutes (advertised)
- 150.9x75.7x8.3mm
- 194g

BUDGET OPTION: iPHONE SE (2ND GENERATION)

Price: £389 from fave.co/30qBvp5

The latest iPhone SE is tricky to review not because it incorporates a lot of interesting new technology to test and explain, but because it does the opposite. Literally nothing here is new. One could write a comprehensive and accurate review in a single short sentence: Apple took and iPhone 8, gave it the iPhone 11's processor, and is charging only £389 for it.

And yet it's that last part, the affordable price, that makes it so interesting. For many millions of potential of customers, a brand-new iPhone has remained out of reach. For so many others, their years-old iPhone is overdue for an upgrade but the new iPhones give them sticker shock.

This phone offers nothing at all to anyone who has an iPhone released in the past couple years, but for its intended audience of iPhone 6 upgraders and 'I got this basically free from my carrier' customers, the new iPhone SE is the most outstanding value since, well, the old iPhone SE.

iPhone 8 redux

At a glance, it's hard to tell the iPhone SE from an iPhone 8. They're exactly the same size with precisely the same button placement – iPhone 8 cases work just fine on the iPhone SE. There are small changes, like the way the iPhone SE's front is all black no matter the back glass colour, or the now-centred Apple logo on the back. In

essence, though, this is an iPhone 8 on the outside.

It's just like the iPhone 8 in most other ways, too. Both have IP67 water resistance. Both support wireless charging. The new phone has the same 4.7in Retina HD (that's approximately 720p) LCD display, too.

You won't really notice that the resolution is a bit limited by today's standards, but you will see that it's not quite as bright as newer phones. We measured a maximum brightness of 750 nits, which isn't bad for a £419 phone, but the iPhone 11 cranked out 900 nits. In bright daylight, that makes a big difference.

If you're a fan of small phones, you'll enjoy the relatively diminutive size and feather-light weight of the iPhone SE. Every iPhone since the iPhone 8 has been bigger, and the rest of the smartphone industry has followed the same trend. Three years ago when it was new, we didn't think of the iPhone 8 as especially small, but it's one of the smaller phones today.

And of course, the iPhone 8 was the last iPhone (until now) to feature a Home button and Touch ID instead of an edge-to-edge display and Face ID. The last couple years of iOS development have focused on gesture control for Home-button-free iPhones, and it feels really weird to go back to using one.

If every iPhone you have ever owned has had a Home button, you'll feel right at, well, home with the iPhone SE. It's understandable that Apple would forgo the expensive TrueDepth module and edge-hugging display on a phone meant to cost only £419, but it still feels like a step back.

The iPhone SE supports wireless charging, as the iPhone 8 did. But if you're coming from an older iPhone, it's new to you.

Performance

The biggest difference between the iPhone

8 and the SE is the processor. The A13 Bionic in the iPhone SE is dramatically faster than the A11 in the iPhone 8.

Benchmarks for the iPhone SE show it to perform essentially the same as the iPhone 11. Single-threaded and multithreaded CPU performance are both about 30- to 40 per cent faster than the iPhone 8 in most benchmarks. Our Geekbench 4 and 5 test results show just what we expect: the iPhone SE performs exactly on par with the iPhone 11, a phone that costs hundreds more. It's faster than nearly all Android phones in these tests, regardless of price.

Geekbench 4 (single-core)
iPhone SE (2nd gen): 5,466
iPhone 11: 5,477
iPhone 8: 4,237

Geekbench 4 (multi-core)
iPhone SE (2nd gen): 13,762
iPhone 11: 13,621
iPhone 8: 10,143

Geekbench 4 (compute)
iPhone SE (2nd gen): 29,049
iPhone 11: 29,362
iPhone 8: 15,228

Geekbench 5 (single-core)
iPhone SE (2nd gen): 1,332
iPhone 11: 1,288
iPhone 8: 921

Geekbench 5 (multi-core)
iPhone SE (2nd gen): 3,225
iPhone 11: 3,338
iPhone 8: 2,398

Geekbench 5 (compute)
iPhone SE (2nd gen): 6,345
iPhone 11: 6,273
iPhone 8: 3,272

Graphics performance takes a big step up, too. Depending on the program, it can be anywhere from 40- to 60 per cent faster than the iPhone 8. Interestingly, while the older 3DMark Ice Storm Unlimited test delivered the results we expect (equal to the iPhone 11), the newer Sling Shot tests were quite a bit slower, though still faster than the iPhone 8. We're not sure what causes this discrepancy, but we ran the tests multiple times to confirm it. No matter – with a display resolution of only 1,334x750, the GPU in the A13 is total overkill. It's going to run any modern graphics-intensive game or program beautifully.

3DMark Sling Shot Extreme
iPhone SE (2nd gen): 4,035
iPhone 11: 5,095

iPhone 8: 3,663

3DMark Sling Shot Extreme Unlimited

iPhone SE (2nd gen): 5,752
iPhone 11: 6,137
iPhone 8: 3,312

3DMark

iPhone SE (2nd gen): 97,534
iPhone 11: 97,106
iPhone 8: 64,349

Machine learning is a whole lot faster, too. While the A11 Bionic in the iPhone 8 introduced Apple's first Neural Engine, newer processors are several times faster at performing Machine Learning tasks. The A13 here is accompanied by 3GB of RAM – up from 2GB in the iPhone 8, but down from 4GB in the iPhone 11.

If you're coming from an older phone, like an iPhone 6s or even the previous iPhone SE, you're going to see a night-and-day difference in performance. Everything is going to fly. Let this sink in for a moment: Apple's £389 phone is, in most respects, faster than the fastest Android phone you can buy at any price.

If there's a shortcoming in the iPhone SE hardware, it's that it has the same battery capacity as the iPhone 8, and essentially the same battery life. Our Geekbench 4 run-down test (with the display set to 200 nits) ran for 3 hours 37 minutes, just 20 minutes longer than the iPhone 8.

Battery life

iPhone SE (2nd gen): 217 minutes
iPhone 11: 333 minutes
iPhone 8: 197 minutes

Mind you, this is running an intensive benchmark in a continual loop, and your actual day-to-day battery life will be a lot longer. I didn't have trouble getting through a full day of regular use. On the one hand, it's impressive to see the same battery capacity last just as long with such dramatically improved performance. On the other hand, the other iPhones, while more expensive, will last a lot longer on a charge.

Photography

The iPhone SE has the same camera sensors as the iPhone 8 – we think. Apple would not answer a direct question to confirm that, though it does have identical specs: the lone rear camera is 12Mp with an f1.8 aperture and optical image stabilization, the front is a 7Mp sensor with f2.2 aperture. The iFixit teardown (see fave.

In good light, the iPhone SE is capable of sharp, colourful, detailed photos with good dynamic range, nearly on par with the iPhone 11 Pro

co/2Yj9r1E) seems to confirm that the iPhone 8 and iPhone SE camera modules are identical.

Apple prefers to focus on the 'camera system', which includes the image signal processor and neural engine of the A13 chip. It's a legitimate point, as so much of smartphone image quality depends on the image processing handled by a variety of specialized parts of the processor.

As a result of the bump from the A11 to the A13, the iPhone SE produces much higher quality images than the iPhone 8, despite using what we believe are the same sensors and lenses. It can pull the iPhone XR's trick of single-camera Portrait Mode on the rear camera, and for the first time ever on an iPhone, on the front camera as well. The iPhone X and later models do Portrait Mode selfies using the TrueDepth module that powers Face ID, but the iPhone SE is the first

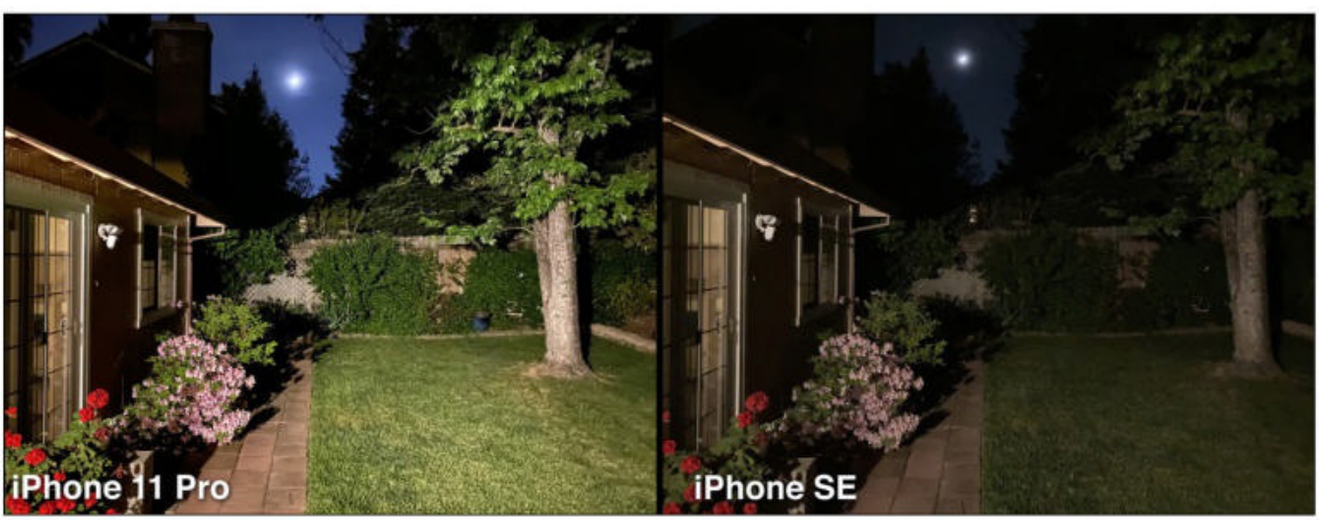
The iPhone SE can do Portrait Mode with its front camera, and the results are good.

If you want Portrait Mode shots of your pets, you'll have to pay more for an iPhone with dual rear cameras.

to do it with just a single standard front-facing camera.

It should be noted that both the front and back camera only perform Portrait Mode and Portrait Lighting in the Camera app when they detect a human face. Portrait Mode shots of your pets or inanimate objects are not available. But the phone is producing an estimated depth map, which means that third-party camera apps could conceivably give you portrait-like effects on any subject.

While the iPhone SE has the same powerful image processing as the latest iPhone 11, because it doesn't



Another trick of the iPhone 11 you won't find in the SE: Night Mode. These shots were produced under identical conditions.

have the same sensors it doesn't produce results that are quite as good. Notably, it's not as good in low light. The Night Mode and Deep Fusion features of the iPhone 11 are totally absent. In good light, the iPhone 11 and iPhone SE take remarkably similar photos. As the light gets worse, the iPhone 11's superiority is clear.

You can take fantastic video with the iPhone SE, too – up to 4K at 60fps, or 1080p at 240fps. The detail, dynamic range, and clarity of video is far superior to any other phone in this price range.

Verdict

The new iPhone SE is perhaps the least interesting iPhone to debut in years. It's just the latest processor stuffed into an old iPhone 8, right? There's nothing new to see here, and that makes it boring to Apple enthusiasts always hungry for the next insanely great thing. But it's precisely because Apple reuses existing parts that it is able to sell such a thoroughly decent new iPhone for only £389. You can pay £50 more to jump from 64GB of storage to 128GB, which is a good value and recommended. Years from now, you'll be glad you did.

This is a fantastic iPhone. It's inexpensive enough that many users will get one by paying something like £5 per month more on their carrier bill, or get it 'free' with the purchase of another phone and a two-year agreement.

The value is off the charts. With the A13 inside, it's faster than Android phones that cost twice as much. Photo and image quality is excellent for this price range. It will get software updates for years where similarly-priced Android phones will be lucky to get a single major Android update.

This clearly isn't Apple's absolute best iPhone, but it's the best choice for many millions of users. It is Apple's least interesting iPhone in years, and simultaneously, perhaps, the most important. It's hard to overstate how big the market is for those who just want an affordable new iPhone that will last another four or five years, even if it doesn't have every new fancy feature. We can only hope Apple doesn't wait another four years to produce another new iPhone SE model.

Jason Cross

Specifications

- 4.7in (1,334x750; 326ppi) Retina IPS LCD capacitive touchscreen
- iOS 13
- Apple A13 Bionic (7nm+) processor
- Hexa-core (2x 2.65GHz Lightning + 4x

1.8GHz Thunder) CPU
- Apple GPU (4-core graphics)
- 3GB RAM
- 64/128/256GB storage
- Rear-facing camera: 12Mp, f/1.8 (wide), PDAF, OIS
- Selfie camera: 7Mp, f/2.2
- 802.11 a/b/g/n/ac/ax Wi-Fi
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS
- Fingerprint scanner (front-mounted)
- USB 2.0, proprietary reversible connector
- 138.4x67.3x7.3mm
- 148g

Review: Apple Watch Series 7

Price: £369 from fave.co/3IMceHd ★★★★½

It's not often that a major new Apple product could be fairly, and completely, reviewed in a single tweet. This may come as close as any ever has: "It's a Series 6 with a slightly bigger display and faster charging," is far less than 250 characters. But it feels like a stretch to find other things to say about the Series 7. This could be the least-significant yearly update to the Apple Watch ever, and while that in no way makes it bad (this is still the best smartwatch around) it's hard not to be disappointed.

A BIGGER DISPLAY

The star of the Series 7 is the display. It's about 20 per cent larger than in the Series 6. Most of this increase in size comes from thinner bezels, but the case is also ever-so-slightly larger.

The always-on display is also a lot brighter outdoors—by 70 per cent, Apple claims.

A 20-per cent increase in screen area is enough to be obvious at a glance, but it's not life-changing. The jump in area from the Series 3 to 4 was more significant, I think. The slimmer bezels are quite nice and it's clear this is the way forward for Apple's smartwatch, but you shouldn't expect it to drastically alter the way you use Apple Watch. And while it's nice to have a brighter always-on display when in direct sunlight, it won't make a huge difference in your day-to-day use.

As someone who needs reading glasses, I can definitely appreciate the fact that all the interface elements and text are larger on the Series 7 thanks to the bigger display. For the first time, Apple has optimized the watchOS interface for a specific watch, and if I'm being honest, the interface the only real upgrade here. Everything else about is minor to the point of near-irrelevance.

The Apple Watch Series 7, right, has a slightly bigger screen than the Series 6.

FASTER CHARGING, SORT OF

What we want more than anything else in an Apple Watch is dramatically better battery life. Apple's competition has multi-day battery life, and while there's no Fitbit with nearly the same capabilities as an Apple Watch, that sort of longevity really changes how you use your watch.

We didn't get more battery life this year. Rather, we got a new USB-C charging cable and some new electronics that allow for faster charging. Sort of.

You need a 20-watt USB-C power adapter (no power adapter is included), and with that, you can get up to 33 per cent faster charging. That

means charging from zero to 80 per cent full in about 45 minutes instead of an hour or so.

Faster charging is always nice, but I didn't find the Series 7 charged faster enough to be all that noticeable. Apple says you can get a full eight hours worth of sleep tracking in just eight minutes of charge, but the same amount of battery life only took about 10 minutes with earlier Apple Watches. If I could 'charge up for the day' in 15 minutes, it would make a real difference in my Apple Watch usage. Instead, a day's charge still takes about an hour. I put it on the stand, do something else for a while, and pick it back up later...same as I always have.

From the side, you'd be hard-pressed to recognize the Series 7 (above) from the Series 6 (below).

In other words, the battery life isn't any different and the faster charging is not really improved enough to change the way you use the device.

STILL IN A LEAGUE OF ITS OWN

There are a few other tiny differences in the Series 7. The front glass is a bit thicker and more crack-resistant. The silver and space grey colours have been replaced with 'starlight' and 'midnight' shades that are close enough to silver and space grey to annoy you that they're not silver or space grey. The blue shade is lighter than it was on Series 6 and looks worse.

Besides slightly worse colours, you'll notice the display is a little brighter indoors, and there are a few new watch faces that don't really need to be exclusive to the Series 7 but are, at least for now.

Everything else is the same. The design is nearly identical, the processor is the same, the sensors are all the same...there's simply not much new in this release. When we reviewed the Series 6, we wrote that the changes "might not seem like

much if you've been using a Series 4 watch or earlier", and the Series 7 is even less of an upgrade.

Does that make it bad? Not at all! The Series 7 is still a better smartwatch than anything else on the market. Giving us the same thing with a slightly larger display is objectively better, and therefore, it's the premium smartwatch we'd recommend.

VERDICT

If you have an Apple Watch that is three or more years old, this is a fine upgrade. It may not be very different from the Series 6, but there's no real reason not to get the Series 7.

Despite that, I find myself put off by the lack of ambition, production issues, or poor execution, or whatever it was that caused Apple to release a whole new, latest-and-greatest Apple Watch that only has a slightly larger display and slightly different colours.

Maybe Apple has refined this miniature wrist computer so much that it simply isn't possible to make more substantive changes every year. And that's okay. Apple could release a new Apple Watch every other year with more significant changes and upgrades, secure in the knowledge that the rest of the smartwatch world is far enough in the rear-view mirror that they won't catch up. We've always known that you don't have to buy a new Apple Watch every year, but the Series 7 has got me thinking that maybe Apple doesn't need to make a new Apple Watch every year.

So here we are, with a perfectly great Apple Watch whose existence I almost resent. I like it, I even recommend it to anyone with an old (or no) Apple Watch. And yet I wish Apple hadn't released it, opting instead to sell the Series 6 for another year until it could offer a more significant upgrade. **Jason Cross**

SPECIFICATIONS

- 1.9in (484x396; 326ppi) Retina LTPO OLED touchscreen
- watchOS 8 (upgradeable to 8.3)
- Apple S7 processor
- Dual-core CPU
- PowerVR GPU
- 32GB storage
- Wi-Fi 802.11 b/g/n, dual-band
- Bluetooth 5.0, A2DP, LE
- GPS with A-GPS, GLONASS, GALILEO, QZSS, BDS
- NFC
- Wireless charging
- Non-removable 309mAh lithium-ion battery
- 45x38x10.7mm
- 42.3g

Apple Watch Series 7 versus Series 6

Is Apple's new wearable a worthy upgrade? **Roman Loyola** reports

The Apple Watch Series 7 is available for purchase, but unlike prior years, there aren't any huge standout sensors or features. Yes, the screen is bigger than the Series 6, but otherwise, the Apple Watch Series 7 isn't a huge upgrade over its predecessor.

That just means you have some time to take a close look at the Apple Watch Series 7. In fact, the Series 6 is still the only flagship Watch you can buy, so you might be able to find a really good price on it before the Series 7 hits shelves. So if you have an older Apple Watch and you want to

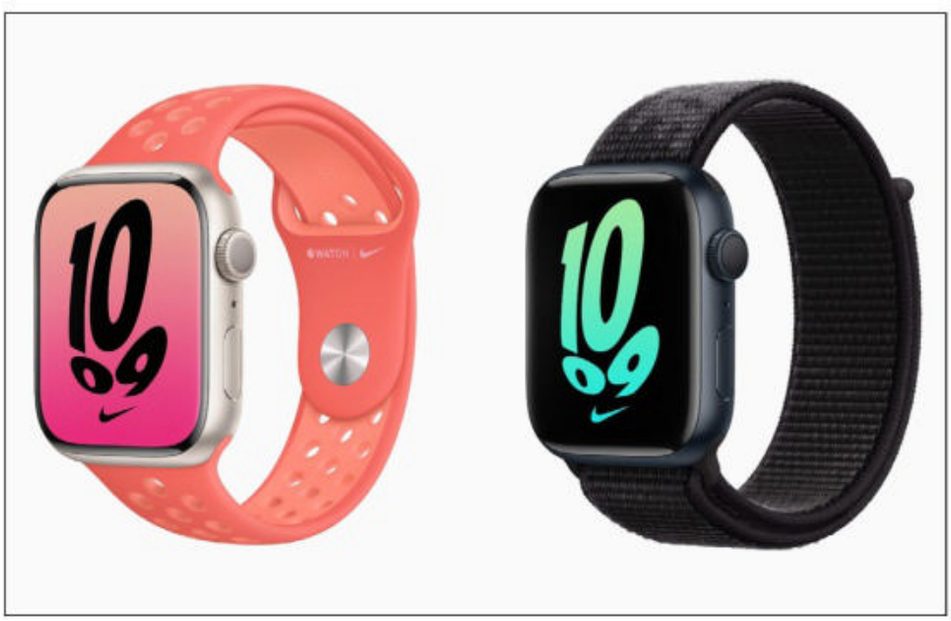
upgrade, or you're looking to buy your first Apple Watch, don't automatically count out the Series 6. Let's take a look at how the two models compare.

Apple Watch Series 7

Entry price: £369
Sizes: 41mm, 45mm
Display: Always-on Retina LTPO OLED display
Brightness: 1,000 nits
Case materials: Aluminium, stainless steel, titanium
Colours: Aluminium: Blue, Green, Midnight, Product(RED), Starlight
Stainless steel: Gold, Graphite, Silver
Titanium: Space Black (DLC), Silver
Display cover: Ion-X glass (aluminium) Sapphire crystal (stainless steel and titanium)
Durability: 50m water resistance, IP6X dust resistance, 50 per cent thicker front crystal
Processor: S7
Battery: Up to 18 hours, USB-C magnetic fast charging cable
Health sensors: Blood oxygen sensor, electrical heart sensor, 3rd-gen optical heart sensor, fall detection
Other sensors: Accelerometer, ambient light, barometric altimeter, compass, GPS, gyroscope
Connectivity: Cellular on GPS + Cellular models, Wi-Fi 802.11b/g/n (2.4GHz, 5GHz), Bluetooth 5.0

Apple Watch Series 6

Entry price: £369
Sizes: 40mm, 44mm
Display: Always-on Retina LTPO OLED display
Brightness: 1,000 nits
Case materials: Aluminium, stainless steel, titanium
Colours: Aluminium: Blue, Gold, Product(RED), Silver, Space Grey
Stainless steel: Gold, Graphite. Silver



Apple Watch Nike Series 7.

Titanium: Space Black (DLC), Silver
Display cover: Ion-X glass (aluminium) Sapphire crystal (stainless steel and titanium)
Durability: 50m water resistance
Processor: S6
Battery: Up to 18 hours, USB-A magnetic charging cable
Health sensors: Blood oxygen sensor, electrical heart sensor, 3rd-gen optical heart sensor, fall detection
Other sensors: Accelerometer, ambient light, barometric altimeter, compass, GPS, gyroscope
Connectivity: Cellular on GPS + Cellular models, Wi-Fi 802.11b/g/n (2.4GHz, 5GHz), Bluetooth 5.0

Design and display

The Series 7 features a design that's still based on a square, but it's a tiny bit more rounded at the corners than the Series 6. Unless you're wearing them together, you probably won't even notice the difference.

The major noticeable difference is the Series 7's larger display. The Series 7 is available in 41mm and 45mm sizes, up from the Series 6's 40mm and 44mm. Consequently, the bezels around the screen are much smaller on the Series 7. In addition to bezels that are 40 per cent thinner, the Series 7's display has a wraparound effect to give it a true edge-to-edge feel, all in a case that's not much bigger than the Series 6.

Both the Series 7 and Series 6 have always-on displays, but the Series 7 is 70 per cent brighter indoors, according to Apple.

Our pick: If you always thought that the Apple Watch screen isn't big enough, then pick the Series 7.

Durability

The Series 7 features a thicker front crystal display that makes it stronger and more scratch- and crack-resistant than the Series 6. The Series 7 is also certified at IP6X dust-tight resistance, while the Series 6 doesn't have such a certification. Both watches have a water-resistance rating of 50m.
Our pick: The Series 6 is by no means delicate, but users who find themselves in extreme situations will have better peace of mind about the Series 7 watch. For everyday use, the Series 6 is fine.

Faces and features

While both watches run watchOS 8, the Series 7's screen makes a big difference across the interface. Apple has tweaked watchOS to take advantage of the larger display so it

now has a full keyboard for texts and typing, something you won't find on the Series 6. Additionally, buttons are larger across all of Apple's apps, making them easier to tap. The Series 7 also has two unique watch faces, Contour and Modular Duo.

Our pick: The differences may be small, but that Contour face is incredibly cool. And if you find on-screen elements on the Apple Watch hard to see or tap, you'll want to go for the Series 7.

Colours and bands

Both watches are available in aluminium, stainless steel, or titanium. The colour offerings for the aluminium models are different between the two models. Here are the colour choices.

Apple Watch Series 7

Aluminium: Blue, Green, Midnight, Product(RED), Starlight
Stainless steel: Gold, Graphite, Silver
Titanium: Space Black (DLC), Silver
Display cover: Ion-X glass (aluminium)

Apple Watch Series 6

Aluminium: Blue, Gold, Product(RED), Silver, Space Grey
Stainless steel: Gold, Graphite. Silver
Titanium: Space Black (DLC), Silver

As for bands, all of the Series 6 bands are compatible with the Series 7 watch.

Like the Series 6, Apple is also offering Nike and Hermès versions of the Series 7. The Nike Series 7 is available in three colours and includes a "refreshed" Nike Sport Loop band and the Nike Bounce watch face. The Hermès Series 7 models include the Gourmette Double Tour and the Circuit H, and new colours for the Classic, Attelage, and Jumping Single Tour models.

Our pick: The Apple Watch is all about style and personal taste, so get the model that reflects your personality. But if you really want a green watch or the new Starlight colour, the Series 7 is the only option.

Performance

Apple finally announced on launch day that the Series 7 has the same S6 processor as the Series 6 (though it's calling it the S7 due to some slight changes). That's not a bad thing – in our review of the Series 6, we said that compared to competitors like the Fitbit Versa or Galaxy Watch, "the Apple Watch will feel like a revelation". Our thoughts haven't changed since that review so we

expect the Series 7 to be plenty fast and powerful. But it's notable in that it's the first time Apple has 't updated the processor in a new model. The watches also both have the same LTE chip for cellular connectivity, so if you're looking for 5G, you'll need to wait for the Series 8.

The Series 7 charges faster than any other Apple Watch.

Our pick: With the same chip and connectivity, both watches will be quite capable, but you're not getting any gains with the Series 7.

Battery life

Apple doesn't provide capacity specs, but the Series 7 Apple Watch has the same 18-hour battery life as prior models. That's enough to get you through the day, but if you want to do sleep tracking, you're going to have to charge the watch.

That's where the Series 7 has a serious advantage. Apple's new watch supports fast charging via a new USB-C charging cable, which Apple claims will charge 33 per cent faster than the Series 6. When you need to charge it, Apple says it only needs to be connected to its charger for eight minutes to be able to cover eight hours of sleep tracking. However, in our testing, we didn't find it was all that much faster than the Series 6, which needed about 10 minutes.

Our pick: The Series 7 is the choice if sleep tracking is a top priority, or your usage is super demanding and often needs to charge in the middle of the day. With lots of small improvements, the ability to fast charge is definitely an advantage for the Series 7, but it still falls short of the battery improvements we really want.

Sensors and features

For the first time between generations, is no difference between the two watches when it comes to health and fitness tracking. Here's what you get:

- Blood oxygen sensor
- Electrical heart sensor
- 3rd-gene optical heart sensor
- Fall detection
- Accelerometer
- Ambient light
- Barometric altimeter
- Compass
- GPS/GNSS
- Gyroscope
- Microphone

Apple's most expensive Apple Watch has a titanium case.

During the Series 7 unveiling, Apple showcased its expanded fall detection, which can now sense an improper fall during a workout and can call emergency services if needed. However, this is a watchOS 8 feature not specific only to the Series 7 and should work just as well on the Series 6 and other watches, too.

Our pick: The sensors are the same, so you can't go wrong with either watch.

Price

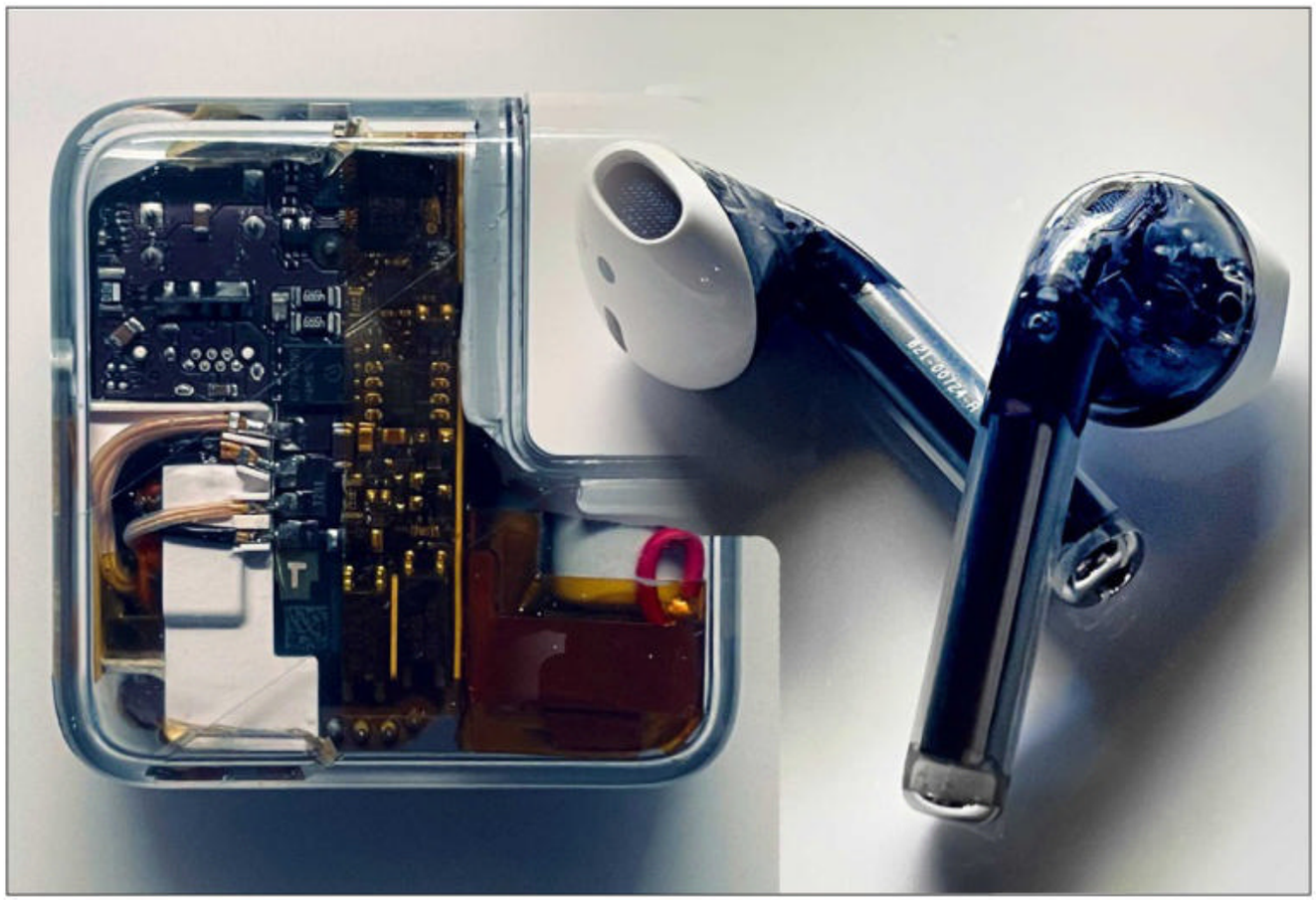
Apple announced that the Series 7 pricing starts at £369, the same starting point for the Series 6. The other options are basically the same as well, with some slight changes based on band choice:

41mm (GPS): £419
45mm (GPS): £449
41mm (GPS+Cellular): £519
45mm (GPS+Cellular): £549
41mm Stainless Steel: Starting at £649
45mm Stainless Steel: Starting at £699

41mm Titanium: Starting at £699
45mm Titanium: Starting at £749

But if you want the latest features, the Series 7 is soon to be your only option, since the Series 6 will be discontinued. While supplies last, you might be able to find a discounted price on a new Series 6 at a third-party retailer, such as Best Buy or Amazon. You'll also be able to buy a refurbished Series 6 at Apple's Refurbished and Clearance store until the stock runs out.

Our pick: All things being equal, the Series 7 is the smarter choice. But if you're looking to save some cash, you'll likely find the Series 6 for less if you shop around, especially after the Series 7 hits shelves. We've seen the Series 6 discounted by as much as £100 and we expect the discounts might be even greater once the new model lands. The two watches are similar with some big differences, but it might be hard to pass up the deep discounts the Series 6 is likely to see.

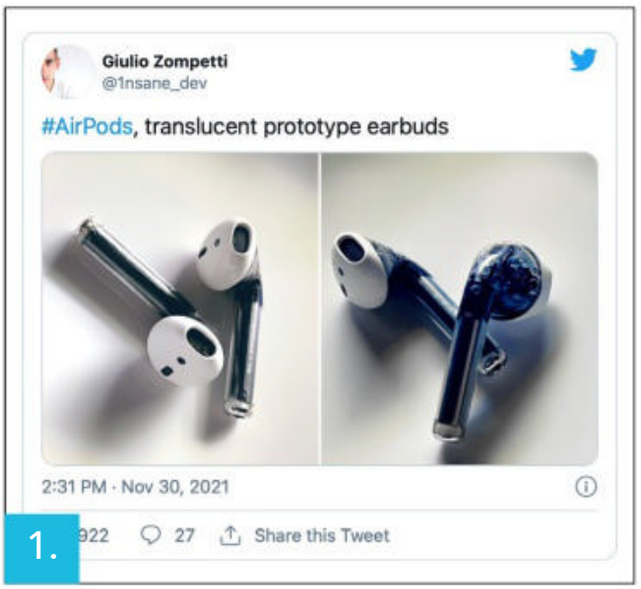


Apple made a pair of clear AirPods and we want them

Rare prototypes make us wish Apple still made transparent devices. **Michael Simon** reports

Lots of people bought Apple products over Christmas because of how they look on the outside, but most of them probably didn't give much thought to the design under the pretty enclosures. But an Apple collector has given us a reason to appreciate what's inside our favourite devices.

Collector Giulio Zompetti has posted pictures of a pair of Apple devices on Twitter that he claims are translucent prototypes of AirPods (**image 1**). It's unclear



why these prototypes were made, but presumably, they were never actually considered for sale but rather used to help with engineering. Still, it's a look that many Apple fans would happily pay for.

Zompetti also shared an image of a clear 29-watt power adapter (**image 2**) that might be even more beautiful than the AirPods. It's less practical, of course, since it would be connected to a wall most of the time, but that doesn't make us want it any less.

Apple had a brief affair with translucent products in the late 90s and early 2000s with the iMac, CRT Studio Display, Pro speakers, and eMate 300, among others. Those clear plastic days are likely behind us, but it's hard not to look at these prototypes and not fall in love with the idea of a line of translucent versions of Apple's current products.

From its earliest days, Apple has made internal design a priority, with the Apple 1 shipping without a case. X-ray shots are popular iPhone wallpapers and transparent side doors were popular after-market mods for the Power Mac G5. It's been many years since Apple released anything translucent, but these products show that Apple's internal design is still a thing of beauty.

IDG